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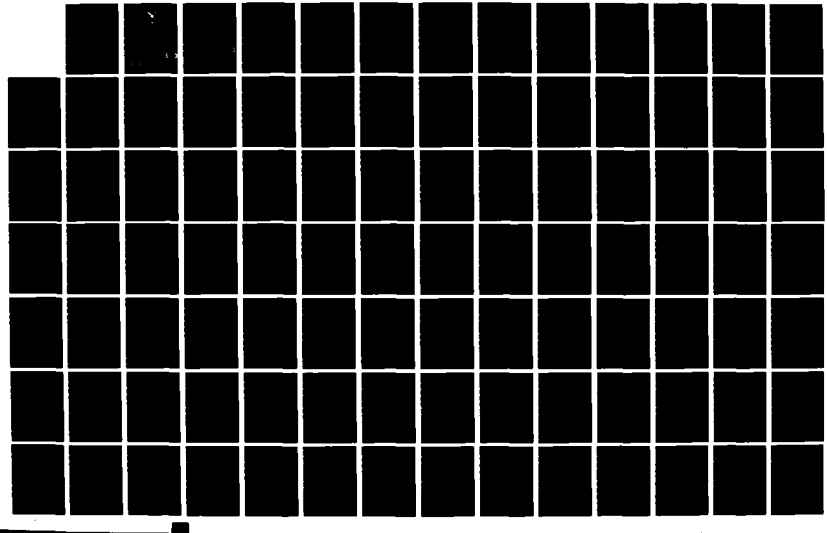

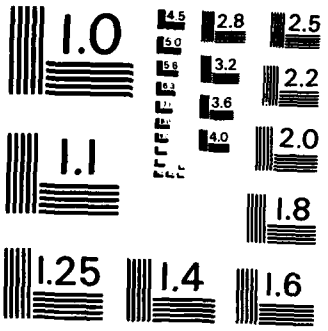

AN ANALYSIS AND COMPARATIVE STUDY OF JOB CHARACTERISTICS LEVELS AND JOB REDESIGN POTENTIAL WITHIN THE STRATEGIC AIR COMMAND MAINTENANCE OFFICER AND NAVIGATOR CAREER FIELDS

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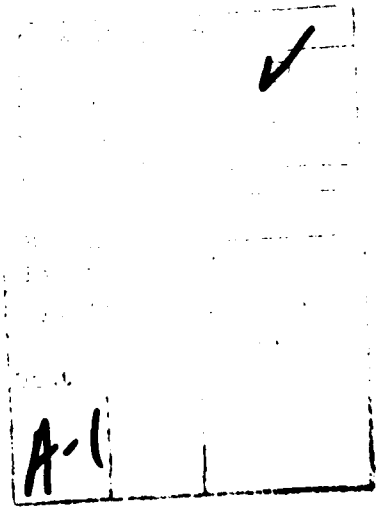

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THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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September 1985

Acknowledgements

We wish to sincerely thank all those individuals who helped make this research effort possible. We thank Dr. Fenno for his time and expertise in helping us secure the needed survey materials and required coordination.

We also thank Dr. Steel and Lieutenant Colonel Ebeling for their invaluable inputs concerning the statistical methods applied in this research.

To our advisor, Major Gourdin, and our reader, Major Byler, a special note of gratitude for their guidance and contributions. Their expert knowledge and advise helped make this research effort a quality product.

A note of thanks to a classmate, Captain Larry Hutchison, for his time and effort expended in producing for us the four full-page graphs contained in the thesis.

Finally, we would like to take this opportunity to give a special thanks to our families for their patience and loving support throughout our time at AFIT.

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ABSTRACT

This study determined the job characteristics levels and potential for job redesign within two Strategic Air Command career fields, maintenance officer and navigator. A survey instrument, the Job Diagnostic Survey, was used to gather the data. The survey results were analyzed and interpreted in the context of Hackman and Oldham's Job Characteristics Model. A literature review thoroughly addressed the Job Diagnostic Survey and Job Characteristics Model, and how these can be applied toward determining the potential for job redesign. The navigator specialty was found to possess a need for job redesign. Survey results showed low scores for the following job characteristics: skill variety, autonomy, motivating potential, and growth satisfaction. The maintenance officer specialty, on the other hand, was not found to need job redesign. The only low job characteristic level was feedback from the job itself. Comparatively, the survey results and Job Characteristics Model indicated that maintenance officers in general are more satisfied with their job than navigators. The research made recommendations on how to effectively redesign the navigator's job and how to improve the feedback aspect of the maintenance officer's job. Conclusions focused on areas for follow-up studies to this research.

AN ANALYSIS AND COMPARATIVE STUDY OF JOB CHARACTERISTICS LEVELS AND JOB REDESIGN POTENTIAL WITHIN THE STRATEGIC AIR COMMAND MAINTENANCE OFFICER AND NAVIGATOR CAREER FIELDS

I. Introduction

> . . . we will know that we are doing something right if we can change the conditions of the job so that employees will stay on and work productively. The way to achieve this end . . . is not to confront them with demands, but to confront them with demanding, meaningful work. And the employee will always have the last word as to whether the work is meaningful (7:199)

Air Force supervisors in all career fields must be constantly aware of their subordinates' attitudes, motivation, and degree of satisfaction toward their jobs in order to maintain an efficient and responsive organization. A commander needs to know the satisfiers and dissatisfiers of a particular job. In chapter one of their book, Work Redesign, Hackman and Oldham characterize satisfiers/dissatisfiers as characteristics that contribute toward positive/negative feelings by an individual toward their job (11). For example, high pay and autonomy may be satisfiers; repetitive tasks may be a dissatisfier. How can one use knowledge of the characteristics of a job to more effectively lead and manage an organization? One way (the focal point of this research effort) is to apply this knowledge in the enrichment or redesign of the job itself. Job enrichment is the restructuring (redesigning) of the conditions of a job such that a worker is more apt to be present and work productively (11:44). For example, the following concepts (developed by Hackman and Oldham) may be employed in enriching a job: workers are given more

responsibility for their schedule and productivity level; direct links are established between the worker and those who use his product or service; tasks are combined so that the worker can identify with a whole piece of work; the job is vertically loaded, that is, the worker is given a wider variety of tasks (some of which were formerly reserved for higher management levels); feedback channels are formed whereby individuals can readily determine their performance while accomplishing the job (10:231). Compare these concepts with the following similar job motivation principles set forth by Ford: let employees know what the organzation's objectives are; let them know how well their work unit is performing with respect to objectives; let employees have the maximum control possible over what they do; permit workers to expand the job as their ability expands or to organize work units so that a final product results from the group; provide employees access to staff support for information and expertise (8:53-54). All of these concepts and principles are used in enriching jobs; enrichment in turn leads to high-quality performance, satisfaction with the work itself, low absenteeism and turnover, and increased motivation (5:203).

Problem Statement

The purpose of this research was to examine the applicability of job enrichment in two selected career fields in the Strategic Air Command (SAC), maintenance officers (munitions and aircraft) and navigators. Specifically, the job characteristics of these two career fields were determined from a survey instrument (Job Diagnostic Survey developed by Hackman and Oldham). The potential for job redesign within each field was assessed using Hackman and Oldham's Job Characteristics Model. The Job Characteristics Model was used in this research effort because it

represents the "best conceptual framework for examining the effects of job enrichment . . . . It explains the psychological impact of various job characteristics and predicts what effects these psychological states will have on work attitudes and performance" (2:232).

SAC maintenance officers and navigators were selected by the authors for two reasons. First, the authors have experience in these career fields and will most likely fill supervisory roles within one or both. Thus, the authors hope to benefit directly from the knowledge gained in this effort. Second, the selection of these specialties allows the research to accomplish another objective: to determine any similarities and differences in the satisfiers/dissatisfiers of a technical, task-specific type of job that is nonsupervisory in nature (navigator) and a supervisory type of job (maintenance officer).

Investigative Questions

This research answered the following questions:

1. What are the motivation, job satisfaction, and growth potential levels within each career field as indicated by the Job Diagnostic Survey and Job Characteristics Model? How do these measures compare with national norms? (established by Hackman and Oldham)
2. Based upon analysis of above measures, what is the potential for job redesign within each field?
3. How do the motivation, job satisfaction, and growth potential levels compare with one another (maintenance officers vs navigators); what job satisfiers/dissatisfiers are common between the two specialties and which are different?

If the analysis indicates that one or both of the career fields has the potential to be enriched then the following issues will be considered:

1. Is it technically feasible to change the job; how much flexibility for change exists?
2. How might the personnel and control systems within the organization affect attempts at job enrichment?
3. What effect might enrichment have on the organization?
4. Are there any general organizational problems or policies that might impede the implementation of a job enrichment effort?

Scope

Maintenance officers and navigators assigned to the Strategic Air Command were surveyed using Hackman and Oldham's Job Diagnostic Survey. Additionally, only those officers in the grade of captain who were not assigned to a high-level staff position were randomly selected to complete the survey. Thus, the survey was limited to navigators who perform line duties (aircrew duties) and other closely associated rated jobs, such as command post, scheduling, or current operations. The survey asks that the navigators presently assigned to one of these closely associated jobs answer the survey based on their prior experience as a crewmember performing the navigator job. In this way the authors hoped to obtain and accurately assess the characteristics of the navigation job itself in SAC. Also, Electronic Warfare Officers (EWO's),who are rated as navigators, were not polled. Similarly, the survey was limited to maintenance officers who fill lower-level supervisory postions, such as maintenance supervisor or branch Officer In Charge (OIC).

The reader should understand that it was not the intent of this research to formulate or develop a redesign program for the two career fields. Rather, the purpose was as stated in the problem statement, that of identifying, measuring, analyzing, and comparing the various job characteristics of the two career specialties.

Assumptions

As mentioned, job enrichment (redesign) can lead to increased worker satisfaction with the task itself. In this context, satisfaction is not necessarily linked with happiness (7:199). The review of two perspectives on satisfaction is appropriate here. One view contends that satisfaction is determined by the total situation at work and at home. Dissatisfaction in one aspect of an individual's life, such as homelife, can spill over and cause dissatisfaction in another, such as work. The other view holds "that an individual's satisfaction can be separated for purposes of study into major areas, such as his job, the pay he receives, his supervisor, the company he works for, and so forth" (27:257).

Literature Review

Job Redesign

> Several authors have suggested that a new ethic has developed in America, particularly among young adults, which stresses autonomy, participation, the pursuit of money . . . . this new ethic seems to call for greater job enrichment and exhorts everyone to aspire to an enriched job simply for the sake of having an enriched job . . . . In earlier decades job enrichment was primarily a means to an end . . . . with the new ethic, however, job enrichment is an end in itself (2:232).

By 1950, history records that there were "numerous human difficulties with traditionally designed work, and some behavioral scientists concluded that the trend toward work simplification and routinization had gone too

far. In response, they (behavioral scientist) began developing alternative approaches to work design" (11:52). These alternative approaches included activation theory, motivation-hygiene theory, and job characteristics theory.

Activation theory suggests that the "nature of the job influences an employee's psychological and physiological activation (or excitation) at work" (11:53). Activation theory has proved to be useful in identifying those jobs that prove to be unstimulating. However, conceptual and measurement problems associated with the theory "make it difficult to apply the theory rigorously in actual work redesign situations" (11:56). Presently, activation theory does not offer specific guidanace on how a job should be structured so as to foster high degrees of satisfaction and productivity (11:56).

Herzberg's motivation-hygiene theory does identify "conditions that promote positive work motivation" (11:56). In formulating his theory, Herzberg referred to Maslow's well-known theory of hierarchy of needs. Herzberg stated that "the factors that lead to positive job attitudes do so because they satisfy the individual's need for self-actualization in his work" (17:114). His theory maintains that factors such as recognition, achievement, responsibility, and advancement determine satisfaction and are hence termed motivation factors. Absense of motivators is not dissatisfying but rather leads to what Herzberg termed a "zero satisfaction" level (24:413). Conversely, hygiene factors (job security, pay, working conditions, fringe benefits, etc.) determine dissatisfaction and hence are preventative in nature. By themselves (i.e. motivatiors are not present), hygiene factors cause zero dissatisfaction and do not motivate individuals to better performance (24:412). Herzberg

equated them with Maslow's lower-level needs. Consider the following example of Herzberg's theory applied to assembly-line auto workers. As a result of experienced worker motivational problems, absenteeism, and high turnover, management instituted such things as wage increases and fringe-benefit programs (hygiene factors). Dissatisfaction was decreased and possibly even reduced to zero but no motivator factors had been introduced. As a result, motivation remained at the same level (24:413). Overall, the theory pointed out the importance of the significance of work itself "as a factor in the ultimate motivation and satisfaction of employees" (11:58). Even though it has met with success, motivation-hygiene theory has been criticized by researchers who have been unable to find any empirical support for the major tenets of the theory. As with activation theory, motivation-hygiene theory seems to suffer from a measurement problem, thus making for difficulties when trying to use the theory in planning and implementing the redesign of a particular job (11:59).

Job characteristics theory, one of the most "elaborate and widely accepted theories of job design" (19:145) considers the objective characteristics of a job. The theory suggests that in order to improve on motivation, satisfaction and productivity, the job should be structured with certain attributes. Arthur Turner and Paul Lawrence, in 1965, studied the relationship between job attributes and the employee's feelings toward their work; this study laid the foundation for job characteristics theory. The attributes they studied included variety, autonomy, interaction, knowledge and skills, and responsibility. Their study maintained that the extent to which these attributes were present in a job would determine the level of employee satisfaction (5:60).

In 1971, Hackman and Lawler used job characteristics theory to examine telephone company jobs. They measured the following job attributes: variety, task-identity, autonomy, and job-based feedback. They predicted that the presence of these attributes would contribute toward an employee's realizing internal motivation which would, in turn, result in good performance (5:60). Similar to motivation-hygiene theory, job characteristics theory is concerned only with those job attributes that can be restructured so as to increase motivation. Additionally, job characteristics theory focuses only on independent jobs; the theory does not offer guidance about "how work should be designed for interacting teams of employees" (5:61).

In 1975, Hackman and Oldham revised job characteristics theory and formulted their job characteristics model. This model "has become the dominant paradign for job design research as well as a popular explanation of the effects of job design on the behavior of human performers" (19:203). A major feature of their Job Characteristics Model that proved helpful in completing this research is its "amenability for use in prechange diagnoses of work systems" (5:60).

The Job Characteristics Model

Hackman and Oldham developed their Job Characteristics Model mainly from research completed by Turner and Lawrence (1965), and Hackman and Lawler (1971). The model is concerned with five core job characteristics: 1) skill variety, 2) task identity, 3) task significance, 4) autonomy, and 5) job feedback. These job characteristics all contribute toward three psychological states possessed by employees; experienced responsibility, experienced meaningfulness, and knowledge of results. Experienced

meaningfulness is a psychological state formed by the attribute's skill variety, task identity, and task significance. Autonomy leads to feelings of experienced responsibility while knowledge of results psychological state is influenced by job feedback (19:146).

The model stresses that all three psychological states are necessary in order for an overall outcome of high internal work motivation to be present. Hackman and Oldham define this internal work motivation as a state of affairs where an individual performs well on a job because it is satisfying to do so. In other words, the individual is well-matched with his job and no coercion is necessary in order to get that individual to work hard and perform well (11:71). Definitions of the five core characteristics and the three psychological states follow (according to Hackman and Oldham):

> Skill Variety - The degree to which a job requires a variety of different activities in carrying out the work, involving the use of a number of different skills and talents (11:78).
>
> Task Identity - The degree to which a job requires completion of a whole and identifiable piece of work; that is , doing a job from beginning to end with a visible outcome (11:78).
>
> Task Significance - The degree to which a job has a substantial impact on the lives of other people, whether those people are in the immediate organization or in the world at large (11:79).

These three core characteristics give rise to the psychological state, experienced meaningfulness: "experienced meaningfulness of the work usually is enhanced when workers understand that the work being done will have a substantial impact on the physical or psychological well-being of other people" (11:79). The model maintains that a person can experience the work as meaninful even if one or two of these three task characteristics are quite low.

> Autonomy - the degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out (11:79).

Autonomy leads to feelings of increased responsibility where "individuals tend to feel more personal responsibility for successes and failures that occur on the job and are more willing to accept personal accountability for the outcomes of their work" (11:80).

> Job feedback - The degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance (11:80).

This characteristic leads to knowledge of results: "knowledge of the results of one's work is affected directly by the amount of feedback one receives from doing the work" (11:80).

The Job Characteristics Model also predicts an overall motivating potential index of a job; the model recognizes that "a given job can be very high on one or more of the five characteristics described above and simultaneously quite low on others" (11:80). Numerical scores for each of the five core dimensions are combined as follows in determining an overall motivation potential score (MPS).

$$MPS = \frac{\text{skill variety} + \text{task identity} + \text{task significance}}{3} \times \text{Autonomy} \times \text{Job Feedback} \quad (1)$$

Notice that a very low score on either autonomy or feedback will result in a low MPS. This is consistent with a basic premise of the model that all three psychological states must be present in order for the outcome of high internal work motivation to be present. Similarly, "a low score on

one of the three job characteristics that contribute to experienced meaningfulness cannot, by itself, seriously compromise the overall motivating potential of a job" (11:81). Hackman and Oldham emphasize in their writings that "the objective motivating potential of a job does not cause employees who work on that job to be internally motivated, to perform well, or to experience job satisfaction. Instead, a job that is high in motivating potential merely creates conditions such that if the jobholder performs well he or she is likely to experience a reinforcing state of affairs as a consequence" (11:82). Job attributes set the stage for internal motivation; the behavior of people who work on a job determines "the action that unfolds on the stage" (11:82).

The model thus recognizes that some people are "much better positioned to take advantage of the opportunities offered by enriched jobs than are others" (11:82). Hackman and Oldham identify three moderating variables in their theory that serve to highlight these differences: knowledge and skill, growth need strength, and satisfaction with the work context. According to the model, an individual who has sufficient knowledge and skill to perform well is more likely to experience positive feelings compared to someone who is not competent. Growth need strength refers to the need that a worker has for personal accomplishment. Some people have a strong need to progress and learn more demanding tasks; others may respond negatively to job enrichment efforts. Satisfaction with the work context is the degree to which a worker feels satisfied with their pay, job security, co-workers, and supervisors. An individual who is not happy with these aspects of a job will probably not be positively motivated by restructuring efforts (11:86). As put forth by Hackman and Oldham:

> What is changed when work is redesigned is the relationship between the person and the work itself. While improvements in that relationship should affect the overall satisfaction of individuals with their jobs, there is no reason to expect that it should also lead to specific improvements in satisfaction with job security, pay, supervision, or co-worker relationships (11:89).

Limitations of the Model

The Job Characteristics Model has prompted extensive empirical research (Arnold and House, 1980; Evans, Kiggundu, and House, 1979; and Champoux, 1980). Other researchers have used this model as a foundation for developing different job redesign theories (Griffin, 1980; Katz, 1978; Umstot, Bell, and Mitchell, 1976) (19:146). However, several authors have criticized the model in management literature. Roberts and Glick (1981) pointed out that many of the "studies stimulated by the model have involved little more than the administration of a single questionnaire and an analysis of the relations among job incumbent's self-reports" (5:205). Roberts and Glick further maintained that little progress has been made in the growth and maturation of the model even after more than eighty studies relevant to the model were completed. In defense of the model, though, Roberts and Glick state that Hackman and Oldham may "have identified, however tentatively, certain job properties or conditions which are important determinants of behavioral outcomes" (5:205). Schwab and Cummings (1976) and O'Reilly (1977), among others, have voiced criticisms concerning the methodology used in collecting and analyzing the data. And finally, Ganster (1980), stated that no studies have been completed where an "orthogonal manipulation" of one or more of the core dimensions was involved (5:206). In their writings, Hackman and Oldham appear to be

objective and honest in their own appraisal of the model. They state: "based on evidence available, it is fair to say that the model probably is more right than wrong, but it is surely inaccurate and incomplete in numerous specifics" (11:95).

Their research does include a validation of the model in which 658 workers in 62 different jobs from 7 organizations were surveyed using the Job Diagnostic Survey (JDS). Using partial correlation and multiple regression analysis, Hackman and Oldham concluded that their model was useable and that a Motivating Potential Score could be predicted with the JDS (12:260).

The Job Diagnostic Survey (JDS)

The survey instrument used to determine scores of the variables in the Job Characteristics Model is the Job Diagnostic Survey (developed by Hackman and Oldham). One of the major uses of the JDS which was employed in this research effort is its ability to diagnose existing jobs prior to any work redesign. Hackman and Oldham compiled JDS score averages for 876 different jobs in 56 organizations (6930 employees). With this data they categorized different job families (clerical, sales, professional, managerial, etc.) and proposed "national norms." The variables measured by the JDS include the five core dimensions, the three psychological states, internal work motivation, growth need strength, and four context satisfactions (satisfaction with job security, compensation, co-workers, and supervision). For purposes of this research, a short form of the JDS was utilized. The short form excludes "measures of the experienced psychological states and uses fewer items to measure other key variables in the Job Characteristics Model" (11:275). However, the five core dimensions are measured by the short form, as well as internal work

motivation, growth need strength and context satisfactions. The authors feel that the use of the short form JDS would thus be sufficient and appropriate for this research effort.

There are limitations and cautions in using the JDS. The JDS has been subjected to a variety of empirical tests in numerous organizations (Cathcart, Goddard, and Youngblood, 1978; Dunham, 1976; Pierce and Dunham, 1978; Stone and Porter, 1977). These tests and studies highlight the following cautions:

1. The job characteristics measured by the JDS are not independent of one another so that a researcher should be careful "not to overinterpret JDS scores for any single job characteristic considered alone" (11:313).
2. The fact that the job characteristics are multiplied together to give an overall motivating potential index can be inaccurate since the measures are less than reliable and intercorrelated (11:313).
3. Many more validity studies are needed to determine that the JDS measures what it is supposed to measure. For example, "evidence regarding the validity of the growth need strength measure is scattered and inconsistent" (11:314).
4. The JDS is not appropriate in diagnosing the job of a single individual. In other words, the reliabilities of the job characteristics measures are higher when the "responses of five or more individuals who work on the same job are averaged" (11:315).

5. Two concepts of the Job Characteristics Model are not assessed by the JDS: knowledge and skill level and employee work effectiveness (a result of high internal work motivation) (11:103).

These cautions, however, do not invalidate use of the JDS for job redesign research. Reliabilities of JDS measures were originally based on data that Hackman and Oldham obtained from 658 workers in 62 different jobs in 7 organizations. These reliabilities were validated by the more extensive survey discussed earlier (6930 workers in 876 jobs and 56 organization).

Hackman and Oldham also performed intercorrelation analyses across all 6930 respondents. They found a consistent pattern which showed moderate intercorrelation among the job dimensions. This does not negatively affect their usefulness as a separate job characteristic if researchers account for this fact when interpreting JDS values (13:23-26).

The objectivity of the job dimensions was also empirically tested. Three groups rated the job dimensions of a particular job: the employees who worked in that job, their supervisors, and outside observers. The ratings conveyed moderately well which lended support for employees objectively rating the characteristics of their own jobs (13:19-20).

The substative validity of the JDS was also evaluated. Hackman and Oldham found that the variables measured by the JDS generally related to one another consistent with the Job Characteristics Model. The most positive relationship occurred between MPS and the three affective outcomes. From their research and testing, Hackman and Oldham concluded that the JDS is a valid measure of the theory concepts in the Job Characteristics Model (13:26-27).

Job Redesign Experiences

> Job enrichment rapidly is becoming one of the most widely used behavioral science strategies for organizational change. And there is scattered but compelling evidence that, under certain conditions, the technique can lead simultaneously to both improved productivity and to an increase in the quality of employee work experiences (7:199). Since the late 1950's the nature of the job a worker is assigned to do has received widespread recognition as an important factor affecting worker motivation (26:28).

There have been numerous job redesign efforts throughout this country. The job enlargement effort at International Business Machines (IBM) in 1943 was one of the earliest experiments with job enrichment (27:11). Although this experiment was mainly one of job enlargement in adding responsibilities and skills to the plant's workers, it set the stage for future job redesign efforts. In 1959, the Polaroid Corporation instituted a job rotation program that "represented a conscious effort to increase the meaningfulness of work by rotating factory operators between their factory jobs and more desirable nonfactory jobs" (9:56). The program was not a resounding success, though it did result in a wealth of information about job rotation. A job exposure program was also tried at Polaroid; in this program a worker was permitted a "relatively long adjustment period on a new job" (9:52). After this period of time the worker went back to his former job and could then apply for a job in the area he just experienced.

Another well-documented job redesign program occurred in the early 1960's at Texas Instruments Incorporated (TI). This was more of a job redesign than the first two examples just cited in that the jobs themselves at TI were restructured. The workers were given supervisory responsibility normally reserved for the management; the workers planned, organized and controlled their assembly work. The research and writings

of Herzberg, Maslow, and McGregor had considerable impact on the program adopted by TI (9:56). The job redesign effort was termed a meaningful work program by management at TI and was highly successful (9:60).

One of the most well-known job redesign programs was the one incorporated at American Telephone and Telegraph Company in the late 1960's. The writings of Herzberg again served as the catalyst for this program. The management at AT&T applied Herzberg's motivation-hygiene theory over a 7-year period in which supervisors were tasked with redesigning their employees' jobs (9:97). AT&T showed improvements in turnover and productivity rates due to the job enrichment program (9:119).

Other examples of job redesign experiments include the industrial engineering division redesign program at Company X in the 1960's; this program attempted to "put more problem-solving activity and control opportunities into operators' jobs" (9:152). At H. P. Hoods and Sons a redesign effort has been in effect for 20 years; the program seeks to involve employees in the problems of the business (9:152). The following list contains some of the most well-known organizations that have undergone job enrichment programs: Bank of New York, Black and Decker, Chrysler Corporation, General Motors, Hewlett-Packard, Humble Oil, Internal Revenue Service, Lockheed Missles and Space Company, Maytag Company, Merrill Lynch, J. C. Penney Company, Qantas Airways, and Reader's Digest (10:193).

The Air Force's first experience with job enrichment was in 1974; a program was begun at Ogden Air Logistics Center and then later implemented at all five air logistics centers (25:75). Each of these experiences proved to be successful. Other commands (SAC and TAC) instituted their own programs after seeing the successes in Logistics Command (16:21).

Summary

This chapter introduced the orientation of this research effort, that of examining the job characteristics and potential for job enrichment within the Strategic Air Command's maintenance officer and navigator career fields. Investigative questions were posed, and the scope and assumptions of the research were identified. A literature review then covered the following: three behavioral job redesign theories, the Job Characteristics Model (the conceptual framework upon which the analysis in this research is based), the Job Diagnostic Survey (the data gathering instrument for this research), and actual job redesign experiences.

II. Methodology

Introduction

The purpose of this chapter is to explain how data was obtained and analyzed. Specifically, the methods of data collection and analysis for each investigative question (pp. 3-4, Chapter I) are explained in detail. Also, the statistical method, hypothesis testing of means, is discussed in order for other interested researchers to easily replicate this work. Finally, the concluding sections focus on assumptions and limitations of the methodology.

Analysis of Investigative Questions

> Investigative Question #1: What are the job characteristics levels within each career field (maintenance officer and navigator) as indicated by the JDS and Job Characteristics Model?

As noted in Chapter I, the Job Characteristics Model is an excellent framework for examining job enrichment and job characteristics. The JDS was developed to specifically address the variables contained in the Job Characteristics Model and so was logically chosen as the data collection instrument (11:103). In addition to the five core dimensions which serve as a foundation for the Job Characteristics Model, the JDS measures two other dimensions, feedback from agents and dealing with others. Their definitions appear below.

> Feedback from agents: the degree to which the employee receives clear information about his or her performance from supervisors or from co-workers (11:104).

> Dealing with others: The degree to which the job requires employees to work closely with other people in carrying out the work activities (including dealing with other organization members and with external organizational "clients") (11:104).

These two characteristics, like the five core dimensions, provide a quantifiable measure of an employee's reaction to his/her job (13:5). Three of the four outcomes of the Job Characteristics Model are measured by the JDS. A measure of the fourth outcome, work effectiveness, cannot be obtained from the JDS. Additionally, the JDS does not provide measurements for one of the model's moderator variables, employees' knowledge and skill. The implications of these two limitations are addressed later in the chapter. Note the following list that summarizes those job aspects that can be quantitatively determined by the JDS.

Job Characteristics (core dimensions)

1. skill variety
2. task identity
3. task significance
4. autonomy
5. feedback from job
6. feedback from agents
7. dealing with others

Affective Outcomes

1. general satisfaction
2. internal work motivation
3. growth satisfaction

Context Satisfactions

1. satisfaction with job security
2. satisfaction with pay
3. satisfaction with co-workers
4. satisfaction with supervision

Individual Growth Need Strength (GNS)

Motivating Potential Score (MPS) - see Equation 1

Hackman and Oldham developed two versions of the JDS, a short form and a long form. The short form can be completed in about fifteen minutes as opposed to about twenty-five minutes for the long version. The psychological states of the Job Characteristics Model (experienced meaningfulness, experienced responsibility, and knowledge of results) are not measured by the short form JDS and some of the variables listed above

are determined with fewer items. The core dimensions, though, are measured identically by both forms. The short form is widely used in job characteristics research. "Its properties, including item format, content and scale reliability have been well documented . . . and [it] has been shown to be a valid and reliable measure of the level of enrichment present in a job" (15:165). With regard to the scope of this research effort, the authors chose to use the short form because it measured all the variables needed for the analysis outlined in the methodology and took less of the respondents' time. A scoring key for the short form JDS is found in Appendix A.

In order to answer investigative question #1, the authors had to decide on the type and extent of survey to be accomplished. Population size for the SAC maintenance officer group (AFSC 40XX) is approximately 250; the navigator population size is approximately 650 (AFSC's 1505, 1525, 1535). Both populations are comprised of captains only. The authors elected to restrict the research to the rank of captain because the typical navigator may fly for about ten years and then career broaden to other jobs. Thus, a large percentage of navigator-rated officers of the rank major or above are not performing navigator duties on a regular basis. The intent of the research was to measure and analyze characteristics of the navigator job itself. The authors reasoned that lieutenants should also be excluded to allow for the completion of on-the-job training. This applies particularly to maintenance officers. Another reason for limiting the survey of maintenance officers to captains is that the JDS is more appropriate for lower-level managers than for middle- and upper-level managers (11:307). Based upon the authors' discussions with faculty assigned to the Organizational Behavior

Department at the Air Force Institute of Technology (AFIT), the JDS can provide meaningful imformation on all types of jobs, supervisory or non-supervisory in nature. Furthermore, based upon the authors' personal experiences in these career fields, an officer holding the rank of captain has had time to mature and stabilize in his/her feelings toward the job. Because of this, the authors feel that by excluding lieutenants, more meaningful and objective findings would result from the research and analyses. Finally, identical ranks for each specialty were chosen to facilitate relevant comparisons between the two.

Random sampling was used in administering the JDS to the approximately 650 member navigator population. As for the maintenance officer population, a census was attempted. In either case, this sampling plan provided an equal chance for each officer in the populations to be surveyed. Return rate of surveys was expected to be 40 - 50%, based on discussions with faculty of the Communication and Research Methods Department (AFIT) and references from other theses that employed survey instruments. In order to determine a desired sample size of the navigator population, the following equation was used (20:7-49):

$$n = \frac{N\,(Z^2)(\sigma^2)}{(N-1)e2 + Z2\ \sigma2} \qquad (2)$$

where N = population size
n = sample size
Z = 1.96 for a confidence interval of 95%
σ = variance
e = tolerance error

A confidence/reliability level of 95% for survey results "is the minimum one normally specified and desired by all professional surveying

organizations" (17). This confidence level means that the sample statistics have a 95% chance of representing the true population statistics within a $\pm$ 5% range. The tolerance error for this research was defined as 0.2. This number was chosen based upon JDS normative means and standard deviations and the rule for detecting significant departures from the norms. For example, the norm mean score for the job dimension skill variety is 4.8 and the standard deviation is 1.2 (sales type of job). According to Hackman and Oldham, "if the target job's scores are less than one standard deviation away from the normative mean, this suggests that there is an insignificant difference between the two scores" (11:316). An error of 0.2 in a sample mean would clearly be well within the standard deviation, 1.2, and should not significantly affect the decision rule. The high values from the normative data table are 6.4 and 1.7: the low values are 4.0 and .54. Chapter I described how the data was obtained; Appendixes B and C contains the normative data tables.

The remaining variable to be determined was the population variance. Since it was unknown, a pilot survey was conducted in order to compute a sample variance which was then used as an estimate of the population variance. Normally a sample size of 30 or greater is needed in order to assure that a sample variance is a reliable estimate of the population variance (21:329). However, Lt. Col. Ebeling, a faculty member of the Operations Research Department (AFIT), assured the authors that a pilot survey of ten navigators and ten maintenance officers would provide a reliable enough variance to determine sample size (3). Twenty AFIT students, known to fit the desired command, grade and AFSC limitations, were selected to complete the JDS. Sample variances from this pilot study were computed to be 2.18 for navigators and 1.90 for maintenance officers.

Solving the sample size equation above using a tolerance error of 0.2 yielded sample sizes of 105 (maintenance) and 158 (navigator).

Based on the above analyses, 250 maintenance officers and 400 navigators were surveyed. A return rate of 40 - 50% would be more than adequate to satisfy the desired sample sizes as computed above. In the census of the maintenance officer group, the authors assumed no systematic bias of those not returning surveys and therefore that those surveys returned represented a valid census.

Name labels for all the individuals in both populations were obtained from the Atlas data base at Air Force Manpower Personnel Center (AFMPC). For the navigator population, each name was assigned a number and then a random number list was used in randomly selecting 400. Government envelopes, mailing labels, and the base reproduction facility were used in preparing the survey packages for distribution. As surveys were returned, the scoring key (Appendix A) was used to compute measures for the sixteen variables previously listed. At this point in the methodology no comparisons of the two specialties were made.

> Investigative Question #2: Based upon analyses of above measures, what is the potential for job redesign within each career field?

Two issues were addressed in answering this question:

1. Is there a need for job redesign?
2. How feasible is job redesign within the career field, given the organizational structure, job characteristics, and employee characteristics.

Hackman and Oldham, in their book Work Redesign, identify a step-by-step process that uses the diagnostic data from the JDS to examine these two issues. The process involves five questions. The first three address the need for redesign and the last two the feasibility of redesign (11:109).

Issue #1: The need for redesign.

Question #1: Are the affective outcomes, internal work motivation, general satisfaction, and growth satisfaction levels within each career field near or below the national averages for these scales (11:111)?

The average scores of each of these three variables were computed for each specialty and compared with the norms (hypothesis testing of means). When analyzing JDS measures of the navigator specialty, the national norms referenced in Appendix B were used for comparison. These norms were compiled by Hackman, Oldham, and Stepina and are based on the responses of 500 non-managerial workers (14:23). JDS measures of the maintenance specialty were compared with those norms found in Appendix C. Hackman, Oldham, and Stepina based these norms on the responses of 6930 employees from 876 different jobs and 56 organizations (14:12). If scores for the affective outcomes were significantly above the norms, then the conclusion was that observed problems within the career field probably have "little to do with the fit between the people and their work, and work redesign may not be appropriate" (11:111). Low scores were largely inconclusive at this point but demonstrated a possible need for job redesign. In either case, the diagnosis continued to the next question.

Question #2: What is the motivating potential of the job?

According to Hackman and Oldham, "there are many possible reasons for poor performance, motivation, or satisfaction. Work redesign is an appropriate change strategy only if there is reason to believe that observed problems may have their roots in the motivational properties of the work itself" (11:111). The motivating potential score (MPS) determined from JDS data can assess how employees see their jobs. A low MPS indicates that the job itself could contribute to low effectiveness

(performance), motivation, and satisfaction levels. Conversely, a high MPS indicates that context satisfactions of the work situation (supervision, pay, security, co-workers) could be possible causes of observed problems (11:111). Using the MPS formula (Chapter 1), the average MPS was determined for each career field and compared with the national norms (hypothesis testing of means). The analysis then continued to Question #3.

Question #3: What aspects of the job most need improvement?

To answer this question a detailed analysis of the seven core dimensions was accomplished. The analysis highlighted particular strengths and weaknesses (satisfiers/dissatisfiers) of the job itself. This analysis was important because "jobs that are nearly identical in MPS can require quite different changes if they are to be motivationally improved" (11:112). The five values in the MPS equation could vary from job to job but still yield the same MPS. Two specific steps were completed in answering question #3. First, a job profile was plotted for each career field. The national norm profile was plotted on each graph, also. An example appears in Figure 1, (the ordinate represents JDS scores). Second, based on the job profiles, those dimensions that seemed low were then compared with the norms using hypothesis testing of means. These two steps served two functions. They identified those job dimensions that were low in value and hence would possibly be prime targets for change. They also prioritized the job dimensions' effects; this information could be useful in developing a redesign program for a particular job (11:115).

With the consideration of the first issue of the need for redesign now completed, the second issue was examined.

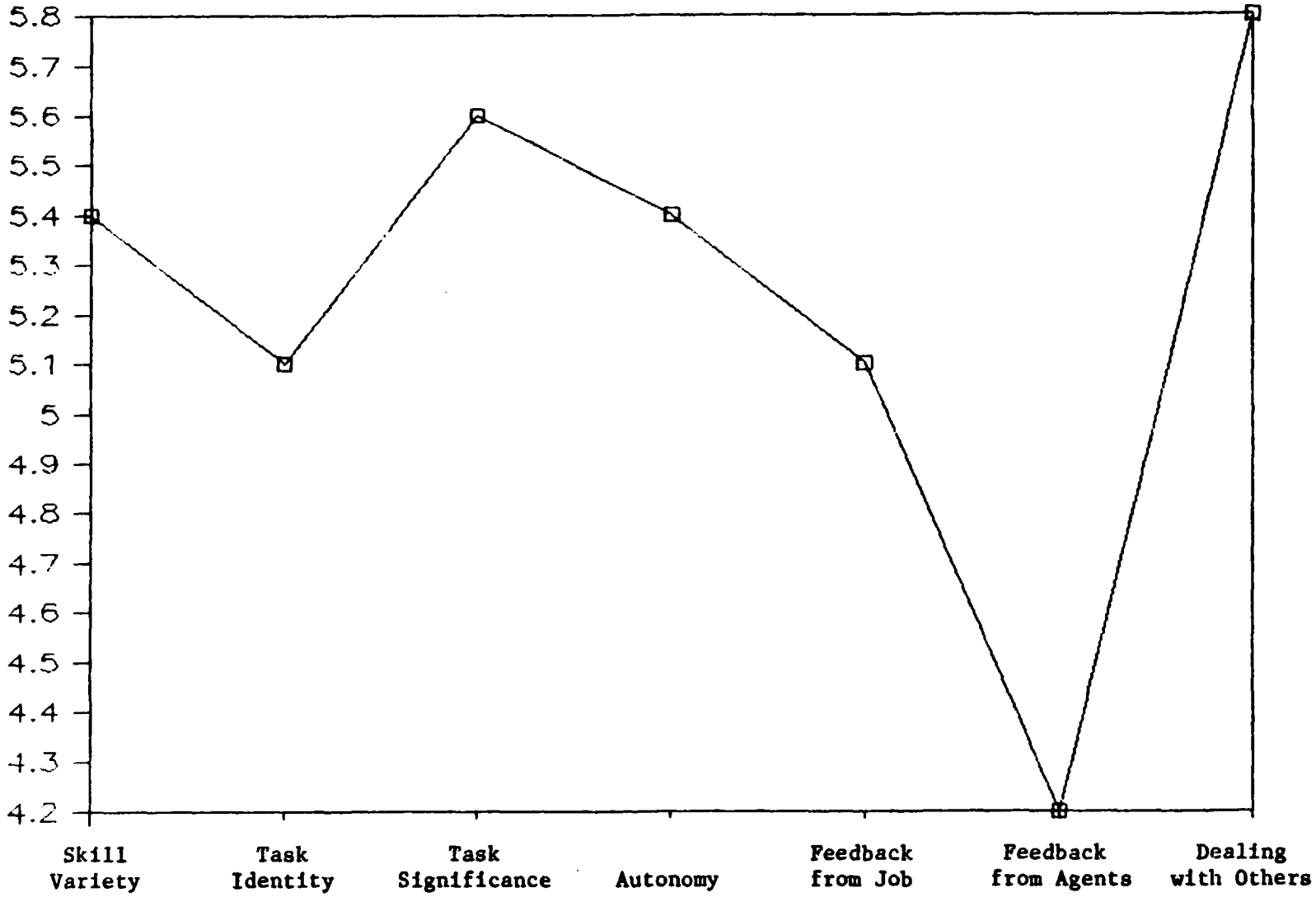


Figure 1. Job Characteristics Profile Sample

Issue #2: Feasibility of job redesign.

As mentioned earlier, two questions were answered in explaining this issue.

Question #1: How ready are the employees for change (11:117)?

The Growth Need Strength (GNS) measure from the JDS can help determine whether workers will respond favorably to an enriched job. However, a low GNS does not necessarily mean that an employee will disfavor job redesign. This is because a person may have "adapted to a worklife that provides few opportunities for personal responsibility and growth," (11:118) and thus expresses a low need for growth. The average GNS for each career field was computed and compared with the national norm (hypothesis testing of means).

To further consider readiness for change, context satisfaction levels should be noted. The context satisfaction measures are "useful indications of the degree to which job incumbents may be preoccupied with problems of pay, job security, co-worker relationships, and supervision, and therefore psychologically unable to exploit the opportunities for growth and personal development that an enriched job can provide" (11:118). The four context satisfactions in each specialty were computed and compared with the national norm (hypothesis testing of means).

To accurately answer Question #1, JDS scores for the GNS, context satisfactions, affective outcomes, job dimensions and the MPS must all be considered within an integrated framework. For example, suppose that a survey of a group of workers results in the following JDS measures:

Job characteristics - low scores for skill variety, task identity, and feedback - others normal.

Affective outcomes - low scores for general satisfaction and internal work motivation - growth satisfaction score high.

Context satisfactions - Pay and supervision scores very low - others normal.

GNS score very low and MPS low.

One might surmise that the low MPS means that the three low job dimensions should be redesigned. However, the low general satisfaction score could result solely from the group's dissatisfaction with pay and supervision. Also, the low GNS and high growth satisfaction score could mean that this group does not seek challenges at work and is satisfied with the present job design. In this case, full-scale job redesign would be inappropriate and would most likely be resisted by this group. Possibly an appropriate change in this example would be to improve the dimension feedback; "information about the adequacy of one's performance often directly improves performance independent of any motivational considerations associated with enriched work" (11:120). For each career field, an analysis similar to the one briefly described above was accomplished. The diagnosis then proceeded to the second consideration for feasibility of job redesign.

Question #2: How hospitable is the organization to needed changes?

Three properties were considered in answering this question: the technological system, the personnel system, and the control system. These aspects are beyond the measurement capabilities of the JDS, but any job redesign effort should thoroughly consider these factors. "The technology of an organization can constrain the feasibility of work redesign by limiting the number of jobs within the technology that can be designed" (11:121). For certain kinds of technology, it is not possible "to build

meaningful amounts of autonomy, variety, or feedback into the jobs" (11:122). Employee discretion is the main key in determining how technology affects job redesign. If work is to be meaningfully redesigned then the "technology must be of the type that provides at least moderate employee discretion or the technology itself must be changed to be compatible with the characteristics of enriched work" (11:122).

The personnel system of an organization may also constrain job redesign efforts if the system specifies fixed job descriptions that detail the who, what, and how of performing a job. "It may be virtually impossible to meaningfully alter the design of jobs in personnel systems where adherence to precise specifications of permissable actions, tools, and work procedures is enforced" (11:123).

The third aspect, control systems, likewise can affect feasibility of work enrichment. A control system is any method "designed to control and influence employee behavior in an impersonal, impartial, and automatic fashion" (budgets, quality control reports, performance reports, etc.) (11:124). Control systems tend to limit the complexity and challenge of jobs. They often specify the assignment of tasks which restricts autonomy in employees' jobs. With job redesign, the existing control systems may cease to function as intended. Thus, job redesign frequently calls for a change in the control system. However, "attempts to change the control systems are very likely to encounter resistance from those who have a personal and professional interest in the preservaiton and refinement of existing control procedures in essentially their present form" (11:126).

Question #2, concerning feasibility, was explored in the context of the three properties discussed above. References, expert opinions, and

authors' personal experiences in the maintenance officer and navigator specialties were used as support.

Each career field was subjected to analysis separately in the previous two investigative questions. The third investigative question compared the two to one another.

> Investigative Question #3: How do the JDS measures from each specialty compare with one another; what job satisfiers/dissatisfiers are different?

Large-sample hypothesis testing of means was used to compare the sixteen JDS measures in order to determine similarities and significant differences. A job profile graph illustrating each specialty's job profile and the national norm profiles was accomplished. Lastly, implications of the results of the above comparisons were proposed.

Cautions Concerning the Use of This Methodology

Some cautions are in order for using the methodology described to assess the need, potential and feasibility of enriching a job. First, when constructing job profiles to identify those aspects that need changing the most, "it is not advisable to rely solely on employee-provided data in constructing them. The views of supervisors also should be collected and considered in identifying the specific motivational strengths and weaknesses of a job" (11:114). A Job Rating Form is available to collect this data.

Another caution is that the JDS does not provide measures for two variables in the Job Characteristics Model, employees' knowledge and skill, and work effectiveness (affective outcome). Work effectiveness judgments must be made by "managers who are familiar with the technology and with the product or service being provided" (11:110). There may be

problems in work effectiveness (quality of work), but these problems may "have little to do with the motivation of the people who do the work" (11:110). Concerning knowledge and skills, "there is no general test that can be given to predict whether employees are competent enough to handle more challenging work" (11:117). Consideration of these variables is important in accurately determining the potential for enrichment of a particular job. Attempts to measure these two variables were considered by the authors to be outside the scope of this research.

A third and major caution concerns using only the Job Characteristics Model and JDS in exploring job redesign of specific jobs. Hackman and Oldham point out repeatedly in their writings that JDS scores should be supplemented with other data, such as interviews or other surveys (Survey of Organizations - Taylor and Bowers, Organizational Assessment Instrument - Van de Ven and Ferry, Michigan Assessment Package) (11:118). They also stress the consideration of other models and theories.

A final caution is that the diagnostic data and answers to the questions presented in this methodology should not be relied upon as unflawed truths. Diagnostic data can be over-interpreted, which could lead to wrong conclusions concerning job redesign need and potential. "The data must be fitted together carefully with other information about the people and the organization, and they must be tested against dominant values about how the organization is to be managed" (11:129). Assessment of job redesign, then, involves complex managerial decision-making that makes judicious use of a well-done diagnosis (11:129).

Statistical Test Used

Throughout the previously discussed plan for diagnosis, statistical test was employed in helping analyze the data. Large-sample hypothesis

testing of means was used in the analyses and comparisons completed for the investigative questions. This statistical method is described below.

Large-sample hypothesis testing of means

The following test procedure was accomplished in comparing the sixteen JDS measures from each career field with the national norms and with each other.

1. The sample mean and standard deviation of the selected measure were computed using the Statistical Package for the Social Sciences (SPSS).

2. Hypotheses were stated in the following form:

   Null hypothesis: sample mean = normative mean
   Alternate hypothesis: sample mean < normative mean or
   sample mean > normative mean
   (normative replaced by other career field when comparing the two fields with each other)

3. A test statistic was computed using the following formula:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sigma_{(\bar{X}_1 - \bar{X}_2)}}$$

where Z = test statistic
$\bar{X}$ = sample mean
$\bar{X}$ = normative mean
σ = standard deviation of the sampling distribution and was computed as follows:

$$\sigma_{(\bar{X}_1 - \bar{X}_2)} = \sqrt{\frac{(S_1)^2}{n_1} + \frac{(S_2)^2}{n_2}}$$

where $(S_1)^2$ and $(S_2)^2$ represent the career field sample and normative sample variances and $(n_1)^2$ and $(n_2)^2$ represent the sample sizes.

These two assumptions apply:

a. The two samples were randomly selected in an independent manner from the two populations.
b. The sample sizes are large enough so that the sample variances provide good approximations of the population variances.

4. The test statistic, Z, was compared to an established critical Z-value. The significance level used throughout the analyses was .05 which yielded a critical Z-value of 1.64. The .05 significance level is commonly used in statistical testing (4:412) and represents the probability of rejecting a null hypothesis that is actually correct (4:408). If the test statistic was less than -1.64 or greater than 1.64, the null hypothesis was rejected and the alternate accepted, that a significant difference existed between the two sample means being compared.

Methodology Assumptions

The following assumptions applied for this research:

1. The empirical properties of the JDS reviewed in Chapter I are satisfactory for the purposes of this research.

2. Even though the national norms generated by Hackman, Oldham and Stepina are based on civilian employee responses, these norms can be applied to military members. Two observations support this assumption. One, the normative measures were categorized by type of work, such as managerial, clerical, sales, service, benchwork, or structural work. These work environments exist in both military and civilian organizations. Two, the principles of job enrichment theories and models apply equally well in Air Force and civilian organizations. Successful job enrichment programs at the Air Logistics Centers were related in Chapter I.

3. The responses from the surveys were assumed to be unbiased since the cover letter on each survey package guaranteed anonymity for the respondent.

4. Despite cautions of using this methodology and limitations of the JDS and Job Characteristics Model, useful and relevant information concerning the job characteristics and potential for job redesign of the SAC navigator and maintenance officer specialties can be gained from this research effort.

Summary

This chapter provided detailed explanations of how the investigative questions proposed were answered. Data collection and analysis were discussed in the framework of a step-by-step diagnosis plan. Cautions for using this methodology were reviewed. Next, the objectives and mechanics of the statistical test employed throughout the analyses were briefly outlined. Lastly, methodology assumptions were enumerated.

III: Data Analysis and Findings

Introduction

The purpose of this chapter is to present the analyses and findings of the research. This chapter follows the same outline as presented in the previous chapter, methodology. The findings and analysis pertaining to each question are presented and in the same order. A final section summarizes the significant considerations and results from this chapter.

Analysis and Findings

Investigative Question #1: What are the job characteristics levels within each career field as indicated by the JDS and Job Characteristics Model?

The Job Characteristics Survey was used to obtain this data. Four hundred surveys were mailed to navigators and 167 (41.75%) were returned; the needed sample size as computed in the methodology was 158. Response rate from maintenance officers was 58.64%; 220 were mailed and 129 returned (needed sample size 105). All the surveys were scored using the key (Appendix A). The results are tabulated in Table 1 (navigator) and Table 2 (maintenance officer). The national averages for technical/professional types of jobs are shown in Table 3 and are used in later comparisons and analyses; national averages for managerial types of jobs are presented in Table 4. As previously mentioned, these national norms were determined by Hackman and Oldham based on 6930 employees from 376 different jobs and 56 organizations (14:12). Standard deviations of the survey results and of the national norms are also included in the tables.

TABLE 1

JOB DIAGNOSTIC SURVEY SCORES FOR
NAVIGATORS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	5.02	1.44
Task Identity	5.09	1.48
Task Significance	5.63	1.59
Autonomy	4.28	1.55
Feedback	5.33	1.28
Feedback from Agents	4.66	1.61
Dealing with Others	6.33	0.95
AFFECTIVE OUTCOMES		
General Satisfaction	4.95	1.66
Internal Work Motivation	5.80	1.19
Growth Satisfaction	4.69	1.56
CONTEXT SATISFACTIONS		
Job Security	4.45	1.79
Pay	4.96	1.62
Co-workers	5.55	1.15
Supervision	4.96	1.54
INDIVIDUAL GROWTH NEED STRENGTH	5.86	1.22
MOTIVATING POTENTIAL SCORE (MPS)	119	

TABLE 2

JOB DIAGNOSTIC SURVEY SCORES FOR
MAINTENANCE OFFICERS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	5.53	1.40
Task Identity	4.54	1.69
Task Significance	6.71	1.45
Autonomy	5.30	1.41
Feedback from Job	4.91	1.48
Feedback from Agents	4.64	1.62
Dealing with others	6.66	0.79
AFFECTIVE OUTCOMES		
General Satisfaction	5.25	1.60
Internal Work Motivation	6.02	1.17
Growth Satisfaction	5.39	1.41
CONTEXT SATISFACTIONS		
Job Security	5.17	1.50
Pay	4.77	1.65
Co-workers	5.69	1.09
Supervision	5.12	1.63
INDIVIDUAL GROWTH NEED STRENGTH	6.16	1.09
MOTIVATING POTENTIAL SCORE (MPS)	141	

TABLE 3

JOB DIAGNOSTIC SURVEY NATIONAL
NORMS TECHNICAL WORKERS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	5.40	1.00
Task Identity	5.10	1.20
Task Significance	5.60	0.95
Autonomy	5.40	1.00
Feedback	5.10	1.10
Feedback from Agents	4.20	1.40
Dealing with Others	5.80	0.96
AFFECTIVE OUTCOMES		
General Satisfaction	4.90	0.99
Internal Work Motivation	5.80	0.65
Growth Satisfaction	5.10	1.10
CONTEXT SATISFACTIONS		
Job Security	5.00	1.20
Pay	4.40	1.50
Co-workers	5.50	0.85
Supervision	4.90	1.30
INDIVIDUAL GROWTH NEED STRENGTH	5.60	0.57
MOTIVATING POTENTIAL SCORE (MPS)	154	

Note: These norms were compiled by Hackman, Oldham, Stepina. They are based on the responses of 500 employees who work in non-managerial positions (13:23).

TABLE 4

JOB DIAGNOSTIC SURVEY NATIONAL
NORMS MANAGERIAL WORKERS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	5.60	0.94
Task Identity	4.70	1.10
Task Significance	5.80	0.85
Autonomy	5.40	0.92
Feedback from Job	5.20	1.00
Feedback from Agents	4.40	1.20
Dealing with Others	6.40	0.58
AFFECTIVE OUTCOMES		
General Satisfaction	4.90	1.00
Internal Work Motivation	5.80	0.64
Growth Satisfaction	5.30	0.97
CONTEXT SATISFACTIONS		
Job Security	5.20	1.00
Pay	4.60	1.20
Co-workers	5.60	0.68
Supervision	5.20	1.10
INDIVIDUAL GROWTH NEED STRENGTH	5.30	0.54
MOTIVATING POTENTIAL SCORE (MPS)	156	

Note: These norms were compiled by Hackman, Oldham, and Stepina. They are based on the responses of 6930 employees who work on 876 different jobs and 56 organizations (13:12)

Investigative Question #2: Based upon analyses, what is the potential for job redesign within each career field?

Issue #1: The need for job redesign.

Question #1: Are the affective outcomes, internal work motivation, general satisfaction, and growth satisfaction levels within each career field near or below the national averages for these scales (11:111)?

Considering the navigator career field, the three affective outcomes were computed and the results are shown in Table 5. The only affective outcome below the national average was growth satisfaction. The other two affective outcomes were in one case just equal to the norm and in the other case just slightly greater (.05 more). Hypothesis testing of means yielded the following results as far as the three outcomes being above, below or even with the norms (based on Z - critical value of 1.64).

TABLE 5

COMPARISON OF MEAN SCORES OF AFFECTIVE OUTCOMES WITH NORMS FOR NAVIGATORS

Affective Outcome	Nat. Norms	Nav. Means	Z-statistic	Significant Difference
Internal Work Motivation	5.80	5.80	0	none
General Satisfaction	4.90	4.95	.385	none
Growth Satisfaction	5.10	4.69	3.23	below

According to Hackman and Oldham, high scores on all three of these outcomes would indicate that job redesign may not be appropriate toward solving problems within the career field. On the other hand, low scores are largely inconclusive except that job redesign could be helpful based on further analysis. Considering the scores for these three outcomes, job redesign could not be ruled out as a viable strategy for the navigator career field. The low score on growth satisfaction indicates a feeling

among navigators that their career field does not offer high potential for growth. This feeling was in fact substantiated numerous times in the remarks section at the end of the surveys (to be exact, references to growth potential were made on 42 of the 167 surveys). It should be noted that remarks and comments at the end of the survey were not required; however, 85 of the 167 surveys (50.9%) contained additional comments.

Considering the maintenance officer career field, the three affective outcomes were computed and are shown in Table 6. All three outcomes were significantly above the norms. Hypothesis testing of means yielded the following results as far as the three outcomes being above, below, or even to the norms (based on Z-critical value of 1.64).

TABLE 6

COMPARISON OF MEAN SCORES OF AFFECTIVE OUTCOMES WITH NORMS FOR MAINTENANCE OFFICERS

Affective Outcome	Nat. Norms	Maint. Means	Z-statistic	Significant Difference
Internal Work Motivation	5.80	6.02	19.7	above
General Satisfaction	4.90	5.25	2.42	above
Growth Satisfaction	5.30	5.39	5.41	above

Based on these results, job redesign may not be an appropriate tool to use within this career field. However, the authors elected not to formulate any conclusions at this point and to consider further analyses of the maintenance officer surveys.

Question #2: What is the motivating potential of the job?

The motivating potential score (MPS) for each career field was computed using the equation 1 shown in Chapter I. The results of these computations are shown in Tables 7 and 8.

TABLE 7

MOTIVATION POTENTIAL SCORE FOR
NAVIGATOR CAREER FIELD

Nav. MPS	Nat. Mean	Z-Statistic	Significant Difference
119	154	6.93	below

First considering the navigators, the national normative MPS for technical/professional type of work is 154. A hypothesis test of means yielded a Z-statistic of 6.93 which means that a significant difference exists between the two means. In this case, the survey MPS was significantly lower than the norm. And as outlined in chapter 2 (Methodology), a low MPS indicated that the navigator's job itself could contribute to any low performance, motivation, or satisfaction levels within the career field. Indeed, the lower than normal growth satisfaction level was discussed in question #1 above. It should also be noted that although the general satisfaction and internal work motivation levels were computed as being equal to the norms, 35 of the 85 surveys that contained comments made negative references to particular aspects of the job itself. The most common grievance was the alert requirement; another was a general dislike of inflight situations. With respect to performance, 15 of the surveys cited a lack of recognition for good inflight and ground training performances, noting that reprimands for poor performances seemed to be readily given.

TABLE 8

MOTIVATION POTENTIAL SCORE FOR
MAINTENANCE OFFICER CAREER FIELD

Maint. MPS	Nat. Mean	Z-Statistic	Significant Difference
141	156	0.47	none

With respect to the maintenance officer sample, the norm MPS for managerial type of work is 156. A hypothesis test of means yielded a Z-statistic of .47 which means that significant difference does not exist between the two means. According to Hackman and Oldham, a high MPS (in this case not necessarily high but not below the norm) indicates that context satisfactions of the job environment (supervisor, pay, security, social) are probable causes of any motivation or performance problems rather than the structure of the job itself. Survey results and hypothesis testing of these context satisfactions are addressed later.

Question #3: What aspects of the job most need improvement?

A job profile of the navigator sample is shown in figure 2: the national norm job profile for the technical/professional category is also plotted on the same graph as a dotted line for easy comparison. The graph clearly shows that the two aspects of the navigator job that most need redesign are skill variety and autonomy. Hypothesis testing of means on these two job dimensions substantiated significant differences from the norms (below the norm). Hypothesis testing on the other 5 core dimensions showed that the survey means were either equal to or greater than the

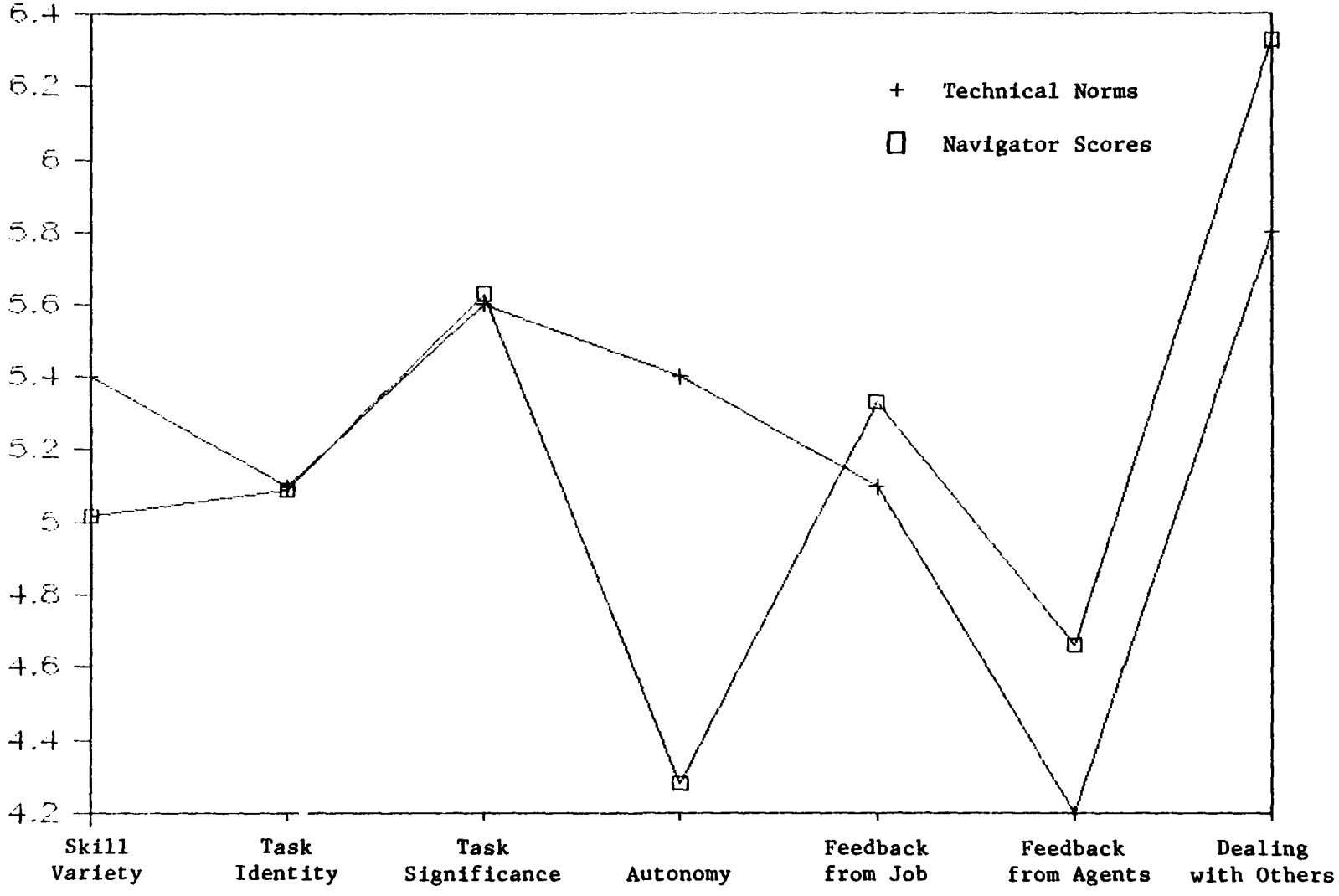


Figure 2. Comparison of Technical Norms and Navigator Characteristics Profiles

national averages. Z-statistic values for each core dimension and the dimension value's relation to the norm are outlined in Table 9.

Thus, for the navigator specialty, the dissatisfiers of the job include skill variety and autonomy while the greatest satisfiers are feedback from the job itself and from agents, and dealing with others.

TABLE 9

COMPARISON OF MEAN SCORE OF SEVEN CORE DIMENSIONS FOR NAVIGATORS

Core Dimension	Nat. Norm	Nav. Mean	Z-statistic	Significant Difference
Skill Variety	5.40	5.02	3.22	below
Task Identity	5.10	5.09	.065	none
Task Significance	5.60	5.63	.235	none
Autonomy	5.40	5.63	8.99	below
Feedback From Job Itself	5.10	5.33	2.11	above
Feedback From Agents	4.20	4.66	3.42	above
Dealing With Others	5.80	6.33	6.14	above

A job profile of the maintenance officer sample is shown in figure 3; the national norm job profile for the managerial category is also plotted on the same graph as a dotted line for easy comparison. The graph depicts the fact that only one core dimension, feedback from the job itself, is below the national norm for managerial type of work. Thus, according to this analysis of the seven job dimensions, only feedback from the job itself needs redesign efforts. Z-statistic values for each dimension and the dimension value's relation to the norm are outlined in Table 10.

For the maintenance officer job, then, the one dissatisfier is feedback from the job itself while the most significant satisfiers include task significance and dealing with others.

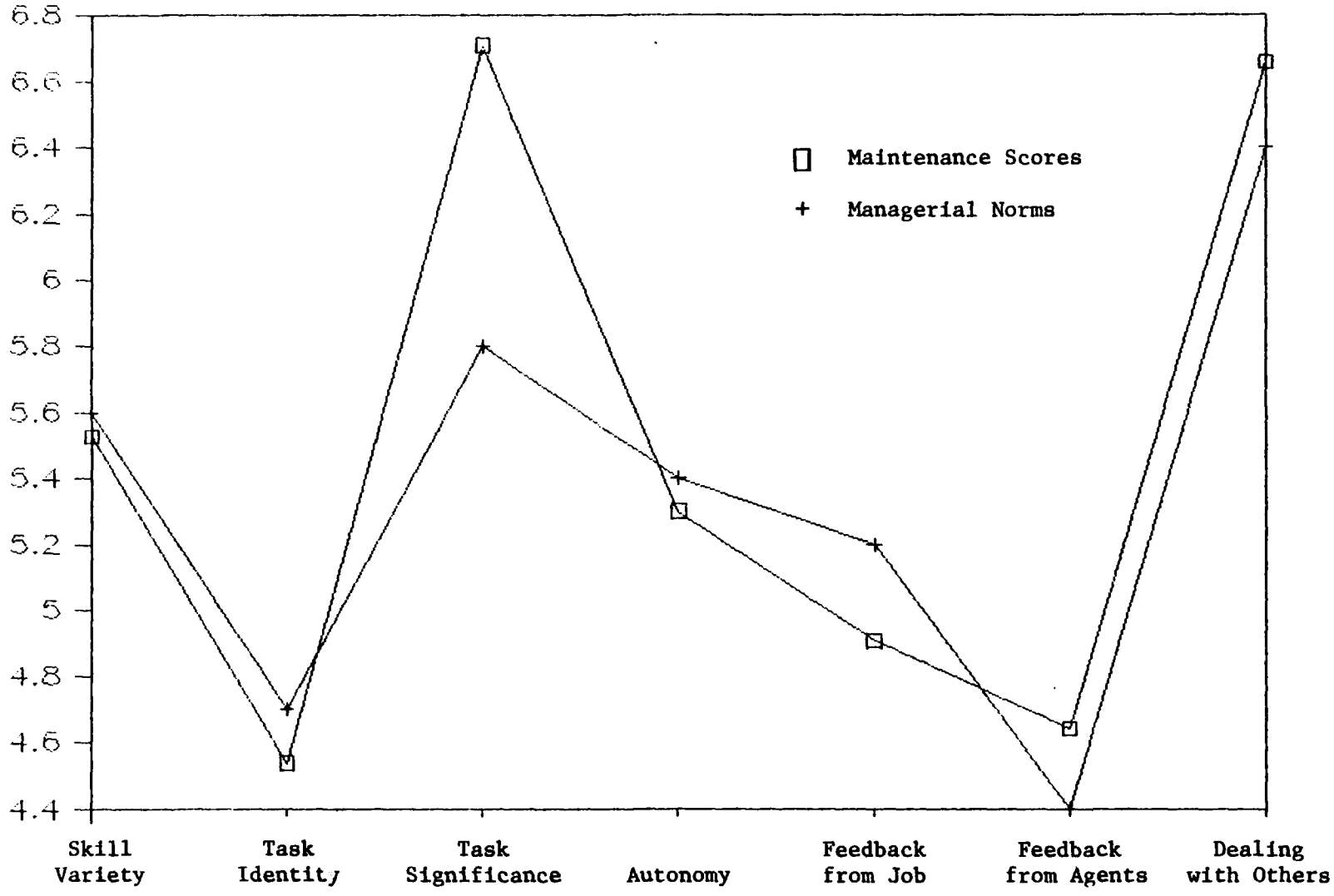


Figure 3. Comparison of Managerial Norms and Maintenance Characteristics Profiles

TABLE 10

COMPARISON OF MEAN SCORE OF SEVEN
CORE DIMENSIONS FOR MAINTENANCE OFFICERS

Core Dimension	Nat. Norm	Maint. Mean	Z-Statistic	Significant Difference
Skill Variety	5.60	5.53	0.59	none
Task Identity	4.70	4.54	1.07	none
Task Significance	5.80	6.71	2.82	above
Autonomy	5.40	5.30	0.78	none
Feedback From Job Itself	5.20	4.91	2.17	below
Feedback From Agents	4.40	4.64	1.63	none
Dealing With Others	6.40	6.66	3.61	above

Issue #2: Feasibility of job redesign.

Question #1: How ready are the employees for change?

To first analyze this issue, the Growth Need Strength (GNS) value was computed as defined by the scoring key. For the navigator sample, the GNS was 5.86 with a standard deviaton of 1.22. A hypothesis test of means (sample compared with normative value of 5.60) yielded a Z-statistic of 2.69 which means that the sample mean for GNS is significantly greater than the national average. Based upon this, the job characteristics model asserts that members within this population (navigators) would respond favorably to job redesign efforts. In other words, the high GNS score indicates a desire for growth or change within the specialty. As outlined in the methodology, to further analyze feasibility of job redesign the four context satisfaction levels were compared with the norms. Table 11 compares the Z-statistic values for each context satisfaction level and depicts the significance of the respective differences.

TABLE 11

COMPARISON OF MEAN SCORE OF CONTEXT SATISFIERS FOR NAVIGATORS

Context Satisfaction	Nat. Norms	Nav. Means	Z-statistic	Significant Difference
Job Security	5.00	4.45	3.78	below
Pay	4.40	4.96	4.10	above
Co-workers (social)	5.50	5.55	0.48	none
Supervision	4.90	4.96	0.44	none

The low score on satisfaction with job security indicates that navigators may be preoccupied with problems of job security within their career field and thus could possibly not fully exploit or appreciate any opportunities that may result from restructuring the job. In the final analysis of how ready the employees are for change, scores of all the variables were considered together. For the navigator sample, Table 12 pictures a concise summary and comparison of the JDS measures with the national averages.

TABLE 12

SUMMARY OF JDS MEASURES COMPARED WITH NORMS FOR NAVIGATORS

Job Characteristics (dimensions) - skill variety and autonomy low, feedback from job and agents and dealing with others high, all others equal.

Affective Outcomes - growth satisfaction low, other two equal.

Context Satisfactions - job security low, pay above, other two equal.

GNS - high.

MPS - low.

Considering the situation above in an integrated framework, there are four factors which reinforce one another and indicate that there is indeed a poor fit between the person and the job. This means that the job definitely could be redesigned with positive consequences. First, the low scores on two job dimensions specifically point to those aspects of the navigator's job that should be redefined in a restructuring effort. Secondly, these two low scores contribute to a motivating potential score that is well below the national average for professional/technical type of work. As stated by Hackman and Oldham, a low MPS means that the job design itself can contribute to poor performance levels and cause motivation problems and dissatisfaction (11:111). Thirdly, the two average and one below average affective outcomes scores also point to a need for redesign. According to Hackman and Oldham, if the scores for affective outcomes are all above the norms, then work redesign may not be appropriate (11:111). Lastly, the above average GNS score indicates that the navigator seeks challenges at work but isn't always provided with them; he has a need for change. In parallel with this finding of a need for redesign, the analysis shows that the navigator is also highly concerned about certain aspects of the career field, namely job security. Because of this, any redesign effort of the job itself that does not change the job security situation may result in little or no improved performance and motivation. Even with a redesigned job that offers skill variety, autonomy, and growth opportunities, the navigator may be preoccupied with feelings of job insecurity and thus not be highly productive and efficient. As mentioned before, the 85 surveys that contained comments support the findings above. Forty-two surveys made

specific references to growth potential and job security. In addition, thirty-five made specific remarks concerning alert duty and inflight duties, stressing the lack of command opportunities and repetitious and boring tasks.

In considering the maintenance officer sample, an analysis similar to that completed for navigators above was performed even though there were earlier indications that redesign may be inappropriate in the maintenance officer specialty. First, the GNS score was compared with the national average (5.30) for managerial type of work. The average for the sample was 6.16; a hypothesis testing of means yielded a Z-statistic of 8.86 which means the sample GNS was significantly greater than the norm. So, the maintenance officer has a need for growth; he seeks challenges at work. Next, the context satisfactions were analyzed with the results shown in Table 13.

TABLE 13

COMPARISON OF MEAN SCORES OF CONTEXT SATISFIERS FOR MAINTENANCE OFFICERS

Context Satisfaction	Nat. Norms	Maint. Means	Z-statistic	Significant Difference
Job Security	5.20	5.17	0.22	none
Pay	4.60	4.77	1.12	none
Co-workers (social)	5.60	5.69	0.91	none
Supervision	5.20	5.12	0.54	none

None of the measures above were found to be below norms which indicates that maintenance officers are not necessarily preoccupied with job security, pay, or supervisory issues. Thus, they should respond favorably to any positive job restructurings.

TABLE 14

SUMMARY OF JDS MEASURES WITH NORMS
FOR MAINTENANCE OFFICERS

Job Characteristics (dimensions) - Feedback from job itself low, task significance and dealing with others high, all others equal.

Affective Outcomes - all high.

Context Satisfactions - all equal.

GNS - high.

MPS - equal.

In the final analysis of how ready the employees are for change, scores of all 16 measures were considered together. For the maintenance officer sample, Table 14 is a concise summary and comparison of the JDS measures with the national averages. Considering the situation above in an integrated framework, two findings are evident. One, redesign of the maintenance officer job is inappropriate as a tool for improving performance, satisfaction, and motivation. In fact, the values of these three affective outcomes are all well above the norms and form the basis for ruling out job redesign. Additionally, the motivating potential score is equal to the national average which means that any observed performance or motivation problems within the career field are most likely not due to the design of the job. Thus, job redesign would be largely ineffective in solving these problems. The other finding is that although generally satisfied with their occupations, maintenance officers do have a desire for more feedback from the job itself, this being the only job dimension rated below the norm. A positive change in this characteristic would be

well received as evidenced by the high GNS score. The maintenance officer seeks challenges at work; more effective feedback from the job itself could thus contribute to improved performance and motivation.

Question #2: How hospitable is the organization to needed changes?

Three properties were considered in answering this question: the technological system, the personnel system, and the control system. As noted, the navigator specialty has a need to be redesigned with emphasis on skill variety, autonomy, growth satisfaction, and job security. However, certain aspects of the technological, personnel, and control systems within Air Force flying organizations would constrain these changes. First, from a technological perspective, recent developments in aircraft navigation systems actually serve to decrease skill variety and autonomy levels within the navigator specialty. Inertial navigation systems have replaced navigators in other aircraft (C-141, C-5); in Strategic Air Command the inertial systems have decreased the variety of personal skills necessary to accurately navigate. Navigators understandably develop low levels of job security and growth satisfaction.

Feelings of autonomy are also negatively affected by these new systems. Whereas the navigator used to take an active role in directing the aircraft (deciding what techniques to use), the new systems have made the navigator more of a systems monitor. From a personnel standpoint, the navigator job is specifically defined in regulations as a support role for the pilot. The job description does not allow for navigators to be aircraft commanders and so high feelings of autonomy are not experienced.

And finally, from a control perspective, the current officer effectiveness reporting system contributes toward the low growth satisfaction and job security levels experienced by navigators.

The maintenance officer career field has a need for improved feedback from the job itself. There are no significant constraints within the technological, personnel, or control systems of a maintenance organization that would preclude instituting this change. It is well within the job descriptions and control mechanisms of upper-echelon maintenance officers to institute more job feedback to lower and middle management maintenace officers.

Investigative question #3: How do the JDS measures from each specialty compare with one another; what job satisfiers/dissatisfiers are different?

Figure 4 is a job profile graph with the navigator profile depicted as a solid line and the maintenance officer shown as a dotted line. Table 15 contains the results of hypothesis testing of means between the two specialties of the seven core dimensions.

TABLE 15

RESULTS OF HYPOTHESIS TESTING
OF CORE DIMENSION MEANS

Core Dimension	Nav. Means	Maint. Means	Z-statistic	Significant Difference
Skill Variety	5.02	5.53	3.06	maintenance higher
Task Identity	5.09	4.54	2.97	navigator higher
Task Significance	5.63	6.71	3.04	maintenance higher
Autonomy	4.28	5.30	5.96	maintenance higher
Feedback From Job Itself	5.33	4.91	4.17	navigator higher
Feedback From Agents	4.66	4.64	0.08	none
Dealing With Others	6.33	6.66	3.24	maintenance higher

Of the seven job characteristics, the navigator sample was higher on two measures, task identity and feedback from the job itself. Based upon these authors' experiences, these results were not surprising. Task

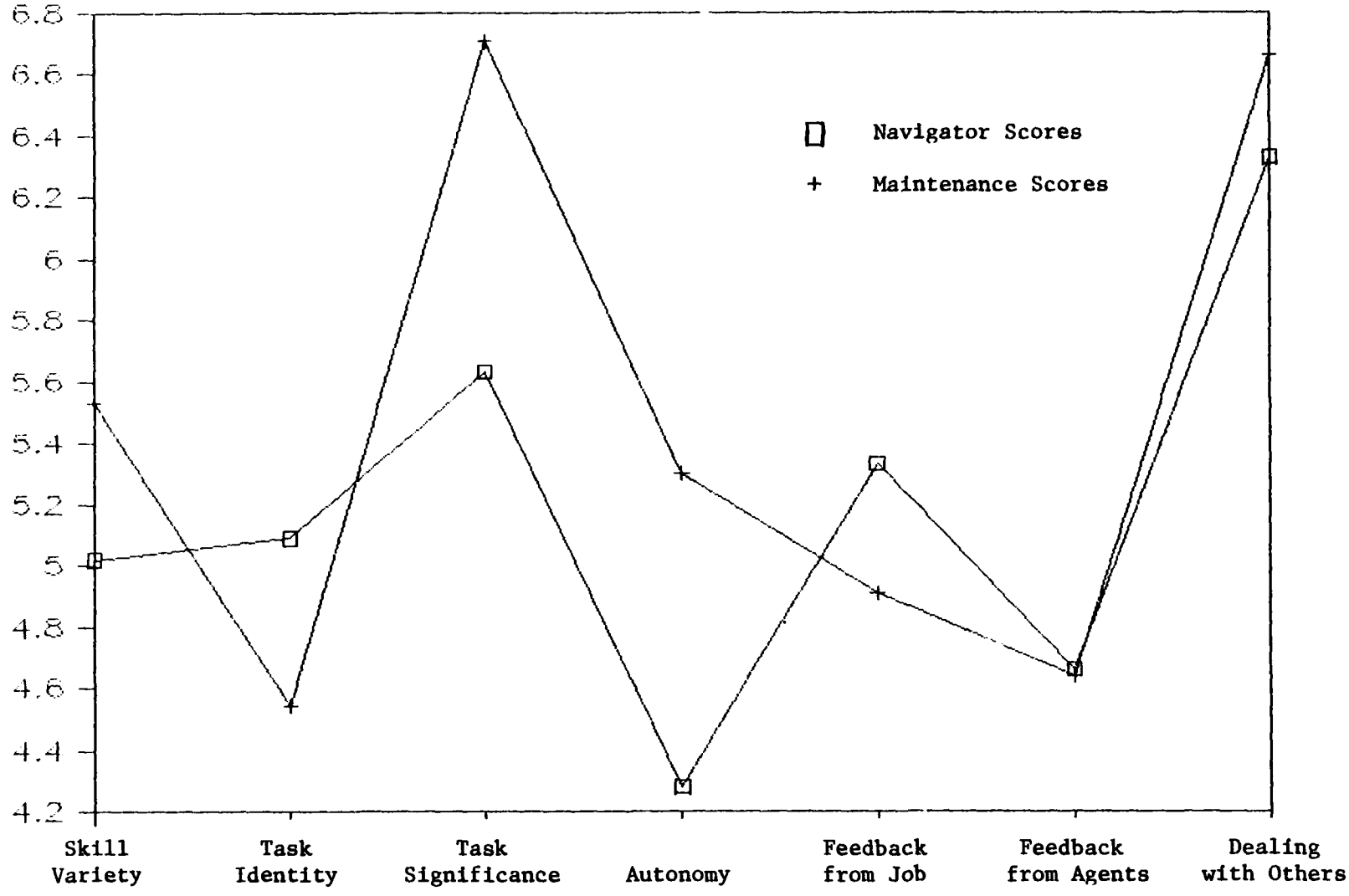


Figure 4. Comparison of Navigator and Maintenance Characteristics Profiles

identity is at a higher level within the navigator specialty since this career field is closer to the actual task of flying a mission than is the maintenance officer. However, the maintenance officer may see himself as performing a more significant or important task as indicated by the higher maintenance officer score for task significance. The navigator closely identifies with the task (mission) but realizes that computer systems have the capability to adequately perform his job. Feedback from the job itself is also understandably rated higher by the navigator group. The navigator has numerous instruments onboard an aircraft which tell him continually how well he is performing. Also, the navigator is subject to annual inflight evaluations and ground evaluations which provide additional feedback. The maintenance officer also receives feedback, but not in such quantifiable terms and formal reports as does the navigator. Of course, being in a managerial capacity, the maintenance officer realizes higher levels of autonomy and dealing with others. The navigator may only deal with the people in the flying unit and with the other people on the crew. The navigator is also performing a technical job and has definite procedures to follow. He does not cope with those managerial-type decisions that must be made daily by the maintenance officer. Lastly, the maintenance officer utilizes a greater variety of skills in performing his duty as compared with the navigator. The navigator is responsible for a determined number of skills and normally experiences routine situations. On the other hand, the maintenance officer's job is not as routine and must employ varying management skills as the situation dictates.

Table 16 contains the results of hypothesis testing of means of the affective outcomes from each sample.

TABLE 16

RESULTS OF HYPOTHESIS TESTING
OF AFFECTIVE OUTCOME MEANS

Affective Outcome	Nav. Means	Maint. Means	Z-statistic	Significant Difference
General Satisfaction	4.95	5.25	1.47	none
Growth Satisfaction	4.69	5.39	4.06	maintenance higher
Internal Work Motivation	5.80	6.02	1.58	none

The only difference between the two specialties here is the higher level of growth satisfaction perceived by maintenance officers. This result was also expected; the maintenance officers can more easily see a path for growth with a career in maintenance whereas normally the navigator is concerned about crosstraining or rated supplement in order to enhance career growth and job security. Even though the other two measures are equal according to the hypothesis tests, the maintenance officer sample scored higher on both. Of course, in comparison with the national averages for each particular type of work, the maintenance officer sample scored above the norms while the navigator sample was equal to the norm on two measures and below on one. This indicated to the authors that in general the maintenance officer is more satisfied overall (general satisfaction) with his job than is the navigator and also derives more internal work motivation from the job itself. In support of this finding, it is important to note here the large difference in the number of surveys containing comments. To reiterate, 85 of 167 navigator surveys contained comments; only 10 of these 85 included positive statements. Thus, 75 out of 167 (45%) of the navigator surveys included negative comments. In contrast, 40 of the 129 maintenance officer surveys

contained comments, of which 18 were negative in nature and 22 positive. Thus,only 18 out of 129 (14%) of the maintenance officer surveys included negative statements. The negative remarks centered around such issues as long hours, lack of praise for successful work, and the influx of rated supplement officers into middle-management positions with no prior maintenance experience.

Next, the comparison of context satisfactions is tabulated in Table 17.

TABLE 17

COMPARISON OF CONTEXT SATISFIERS BETWEEN CAREER FIELDS

Context Satisfaction	Nav. Means	Maint. Means	Z-statistic	Significant Difference
Job Security	4.45	5.17	3.78	maintenance higher
Pay	4.96	4.77	1.01	none
Co-workers (social)	5.55	5.69	1.10	none
Supervision	4.96	5.12	0.89	none

The most significant difference concerning the above satisfaction measures is obviously job security. For reasons discussed previously, the navigator experiences a higher level of job insecurity feelings than does the maintenance officer. It should also be noted that even though a comparison of the pay scores does not indicate any difference, the navigator sample was higher than the national average for pay whereas the maintenance officer sample was equal. More than likely this indicates the incentive flying pay that the navigators receive.

The last two measures, GNS and MPS, and the comparisons, are shown in Table 18.

TABLE 18

COMPARISON OF GNS AND MPS BETWEEN CAREER FIELDS

	Nav. Means	Maint. Means	Z-Statistic	Significant Difference
Growth Need Strength	5.86	6.16	2.23	maintenance higher
Motivating Potential Score	119	141	3.12	maintenance higher

Compared with their respective national norms, both career specialties indicated a need for growth; both groups would thus respond favorably to positive changes. However, the low context satisfaction score for job security in the navigator sample indicates that changes may not improve performance and motivation levels within the navigator specialty as they would in the maintenance officer specialty. The navigator group is preoccupied with feelings about job security whereas the maintenance officer group has no preoccupations and could fully exploit opportunities resulting from change. Lastly, the higher maintenance officer sample score for MPS indicates that there are, overall, more motivating properties inherent in the maintenance officer job itself than in the navigator job. Compared with their respective norms, the maintenance officer MPS (although slightly lower in absolute terms) is not significantly different; on the other hand, the navigator MPS is significantly lower than the norm.

Summary

This chapter presented the data analyses and findings of the research. All sixteen job measures of each career specialty were compared with the national averages. The maintenance officer sample was compared

with the managerial category norms while the navigator sample was compared with the professional/technical category norms. Hypothesis testing of means were accomplished to determine any significant differences. The results from each career field were then compared with each other; similarities and differences were discussed.

IV: Conclusions and Recommendations

This chapter is the final section of this research effort and offers conclusions and recommendations based upon the analyses and findings discussed in chapter 3. The authors also drew upon their experiences in the maintenance officer and navigator career fields in formulating the ideas and proposals presented here. Conclusions are enumerated first, followed by recommendations.

Conclusions

The following conclusions resulted from this research:

1. Regarding the navigator specialty, analysis of the Job Diagnostic Survey measures (16 variables) indicated a need for redesign of the navigator's job, particularly in the areas of skill variety and autonomy.

2. Low scores on two measures, growth satisfaction and job security, indicated that navigators are preoccupied with negative feelings toward career growth and job security. This preoccupation would tend to dampen the positive effects of a redesign effort.

3. Based upon these authors' experiences, the redesigning of skill variety and autonomy in the navigator job would be significantly hindered by the technological, personnel, and control factors currently present in SAC flying organizations.

4. Regarding the maintenance officer specialty, analysis of the 16 measures indicated a need to improve one aspect of the job, feedback from the job itself. Redesign of the job was ruled out as an appropriate tool for improving performance and motivation.

5. Based upon these authors' experiences, the technological, personnel, and control systems in effect in maintenance organizations would not significantly impede changes designed to improve feedback. However, further study would need to be accomplished to fully ascertain the actual hindrances that would be met by implementing changes.

6. Based upon comparisons between the two specialties, the maintenance officer is overall more satisfied with his job than is the navigator. The maintenance officer sample had high scores for the three affective outcomes, indicating that the fit between the person and job was effective and satisfying. On the other hand, the navigator sample scored just at the norms and in one measure below the norm, indicating a poor fit between the person and the job. Also, the maintenance officers are more satisfied with their job and career situation than the navigators as verified by the context satisfaction scores. The scores for these measures were all normal for the maintenance officer sample while the navigators scored low on job security.

7. Both career fields are manned by highly educated personnel who desire challenges in their work and opportunities to grow and advance in their specialties. An analysis of the biographical data from the surveys indicated that for the navigator sample, 35 out of the 167, or 21%, had completed a master's degree. For the maintenance officer sample, 24 out of the 129, or 16.5%, had completed a master's degree. The high Growth Need Strength (GNS) scores verified this desire for challenge and growth. More importantly for the navigator career field, the high GNS indicated that a job redesign effort would be favorably received.

Recommendations

The authors formulated the following recommendations based on this research and analyses and personal experiences.

1. Concerning the navigator specialty, this research identified two significant situations within the career field. One, the navigator's job itself lacks a demand for a variety of skills and offers very little autonomy (navigators do not supervise others and cannot be aircraft or mission commanders). Secondly, navigators view their career field as one with very limited growth potential and high job insecurity. Any redesign effort should consider both of these issues. The resolution of only one of the issues and not the other may not have signficant effect on the overall satisfaction level of navigators towards their jobs. For example, suppose that the Air Force decides that the promotion rate to major for navigators is to be increased 10% but the actual nature of the job remains the same. Even though the navigator may feel more secure and see more chance for advancement, he will still be dissatisfied with the skill variety and autonomy characteristics of the job. Conversely, suppose that skill variety and autonomy levels are increased but that career growth is still limited. Now he may be satisfied with the job itself but still feel dissatisfaction with the job in a career sense. Both issues must be addressed. Performance, effectiveness, and motivation problems would not necessarily be solved by considering only one of the issues. Technological advances are replacing navigators; and in those aircraft where navigators still perform inflight navigator duties, there is no opportunity for them to advance to an aircraft commander type of position. Most likely these facts will not change in the foreseeable future. So how

can skill variety and autonomy be designed into the navigator's job? It would be very impractical and costly to modify existing cockpits to allow the navigators to utilize more skills and exercise autonomy. Perhaps skill variety and autonomy can be programmed into the navigator's job situation outside the cockpit. Navigators could perform other functions in the squadron and wing. They could be tasked with additional duties that require the use of management skills. It was the authors' experiences in SAC that crewmembers do have sufficient spare time where, say, half a day or even a whole day, could be spent each week working in a responsible, supervisory type of position. SAC does have an additional AFSC program, Officer Career Development Program, where officers may earn an entry level AFSC through part-time work in that area. But only a relatively few participate in this voluntary program. Suppose a program of this type was made mandatory. In other words, a part of the navigator's total job environment is working in a management capacity once a week. Career growth would be enhanced, differnet skills than those required inflight would be learned and practiced, and more positive feelings toward autonomy and job security would result. This would also help the Air Force in the future because the navigators would acquire the ability to manage and lead.

2. Feedback from the job itself was the only area where the maintenance officers scored below the national norm. Two other closely related areas where they barely scored even with the norms were supervisory satisfaction and feedback from agents. Feedback from the job is closely tied with both of these two areas. Supervisor satisfaction, according to the survey comments section,is a very distressing area for many maintenance officers. Many feel the only time they see their

supervisors or receive feedback is when something goes wrong or when somebody important is inspecting. Feedback from agents needs to be an on-going program to insure the maintenance officer is accomplishing what is expected. Many survey comments relayed the message "I want to know if I do things right, when I do things right. If I am doing things wrong, don't just tell me I am wrong, show me how to do it right." The authors feel that from their experiences and the comments returned on the surveys, that a scheduled program would be a possible solution to the problem. For example, some maintenance officers are assigned to a senior maintenance officer (Assistant Deputy Commander for Maintenance) upon first arriving on base. In SAC, this is done to insure that junior officers get all required training completed.

This could be expanded into a program where every company-grade maintenance officer is assigned to a senior maintenance officer for the total time of their tour. Periodically (monthly), the supervisor and his subordinate would meet and discuss the achievements and downfalls of the maintenance officer. They would discuss ways of improving management techniques, planning skills, and training strategies of the maintenance officer. This would create a positive learning condition and would improve the overall position of maintenance officers in their organizations. The authors believe this type of "executive training program" would improve feedback from the job, feedback from agents and supervisory satisfaction. With this type of program, SAC would have fewer maintenance officers looking for "greener pastures", as one officer stated on the survey.

3. Since the purpose of this research was to analyze job characteristics and the potential for redesign and not to formulate actual

plans for restructuring, the anlysis of the technological, personnel, and control systems effects on redesign was not detailed. Before any redesign ideas such as the ones presented above could be implemented, a thorough study of the technological, personnel, and control systems' impact on redesign would need to be completed. Concerning the navigator specialty, the following concerns would be important: the impact on alert and mission readiness if navigators were to work in a management capacity once a week; the future role of the navigator in the aircraft, his replacement by advanced systems or his continuing on as a systems monitor; the redefining of the navigator's job description if he were required to also perform in a management role; how the navigator's effectiveness reports would be completed and their tone. The maintenance officer's concerns would be: the impact on the maintenance officers role in his day-to-day job; the integrity and skill of the senior maintenance officer to whom he is assigned; and the effectiveness reports and how they will be affected by any changes in current attitudes.

4. This research did not address the level of performance or effectiveness within the two career fields. The maintenance officers studied appear to get apprehensive in their jobs because of lack of feedback. The authors believe that this does not effect performance and effectiveness to a great extent, but it could if continued for a long period of time. Many average maintenance managers would be outstanding if given proper feedback from the job and supervisors. Managerial training by proven managers would be one solution. Further study of the maintenance specialty is needed to determine the extent to which lack of feedback impacts performance and effectiveness. Regarding the navigator specialty, however, the authors suspect that, in general, the navigators

studied in this particular population do not fully exploit their potential either in terms of performance or providing effective inputs within their organizations. Further study could be done to verify a direct relationship between dissatisfaction with the navigator job and low level of performance. If research did in fact determine that the design of the navigator job was adversely impacting performance and effectiveness, then certainly serious consideration should be given to restructuring the work.

5. The findings and conclusions that resulted from the diagnostic data gathered during this research should not be assumed to be correct without further study. Only one methodology and one survey instrument were employed; multiple methodologies and data gathering techniques should be used to thoroughly assess job characteristics and the potential for redesign. According to Hackman and Oldham, "only by using multiple methodologies, involving data from multiple observers, can diagnosticians protect themselves from systematic distortions in the conclusions they reach" (10:102). Of course, if the findings from other methodologies prove similar to those presented in this research, then one may conclude that the authors' findings do accurately assess the work situation in the maintenance officer and navigator career fields. The authors recommend that in order to verify the accuracy of the findings presented here other data gathering methods, such as interviews, observations, or further diagnostic surveys, should be employed. Also, multiple observers should be questioned, such as supervisors, staff members, peers not working in that particular job, and outside consultants. The Job Rating Form is a survey that was designed as a companion instrument to the Job Diagnostic Survey and is completed by supervisors and disinterested outsiders. Like the JDS, the Job Rating Form collects data on the characteristics,

motivational strengths, and weaknesses of a job. Frequently, the shape of the job profiles provided by job incumbents and those outside the job are similar. However, if differences were found, then additional study would be needed to determine why the differences exist before an accurate assessment of the potential for job redesign could be made. The Job Rating Form could be administered to the supervisors of captain maintenance officers and navigators of the population surveyed in this study. The results could then be compared with the results obtained by the authors through the JDS.

Thus, as a follow-on area of study to this thesis, the same (SAC) maintenance officer and navigator groups could be surveyed using a different instrument, such as the Job Characteristics Inventory (JCI) and their supervisors could be surveyed using the Job Rating Form. Three sets of diagnostic data would then be available from which highly credible and accurate conclusions could be obtained.

Summary

As evidenced by the conclusions and recommendations presented above, there are many issues that could be researched as follow-on study. This research has set the initial framework for identifying the job characteristics of the maintenance officer and navigator specialties and problem areas within these specialties that may need to be changed or redesigned. Time and resources necessarily limited this research effort; as such, the conclusions and recommendations presented are only introductory in nature and are not meant to be all encompassing. They do, however, provide a base from which other hypotheses may be explained and analyzed. The authors gained invaluable insight from this effort as far as realizing some of the satisfactions and dissatisfactions that

navigators and maintenance officers experience in their work environments. Future assignments in the Air Force for the authors will be in supervisory capacities within each career group studied. So the gained insights should prove valuable to them as they strive to maintain efficient, effective, and highly motivated organizations. As officers, leaders, and managers, that is our duty.

APPENDIX A: SCORING KEY FOR THE JOB DIAGNOSTIC SURVEY

The scoring manual for the Job Diagnostic Survey (JDS) is presented below. For each variable measured by the JDS, the questionnaire items that are averaged to yield a summary score for the variable are listed.

I. JOB CHARACTERISTICS

A. Skill variety. Average the following items:

Section One: #4
Section Two: #1
#5 (reversed scoring-i.e., subtract the number entered by the respondent from 8)

B. Task identity. Average the following items:

Section One: #3
Section Two: #11
#3 (reversed scoring)

C. Task significance. Average the following items:

Section One: #5
Section Two: #8
#14 (reversed scoring)

D. Autonomy. Average the following items:

Section One: #2
Section Two: #13
#9 (reversed scoring)

E. Feedback from the job itself. Average the following items:

Section One: #7
Section Two: #4
#12 (reversed scoring)

F. Feedback from agents. Average the following items:

Section One: #6
Section Two: #10
#7 (reversed scoring)

G. Dealing with others. Average the following items:

Section One: #1
Section Two: #2
#6 (reversed scoring)

II. AFFECTIVE OUTCOMES. The first two constructs (general satisfaction and internal work motivation) are measured directly (Section Three); growth satisfaction is measured directly (Section Four).

A. General satisfaction. Average the following items:

Section Three: #2, #6
#4 (reversed scoring)

B. Internal work motivation. Average the following items:

Section Three: #1, #3, #5
#7 (reversed scoring)

C. Growth satisfaction. Average the following items:

Section Four: #3, #6, #10, #13

III. CONTEXT SATISFACTIONS. Each of these short scales uses items from Section Four only.

A. Satisfaction with job security. Average items #1 and #11 of Section Four.

B. Satisfaction with compensation (pay). Average items #2 and #9 of Section Four.

C. Satisfaction with co-workers. Average items #4, #7, and #12 of Section Four.

D. Satisfaction with supervision. Average items #5, #8, and #14 of Section Four.

IV. INDIVIDUAL GROWTH NEED STRENGTH. The questionnaire yields the measure of growth need strength from Section Five (the "would like" format).

A. "Would like" format (Section Five). Average the six items from Section Five listed below. Before averaging, subtract 3 from each item score; this will result in a summary scale ranging from one to seven.
The items are:

#2, #3, #6, #8, #10, #11

V. MOTIVATING POTENTIAL SCORE.

$$\text{Motivating Potential Score (MPS)} = \frac{\text{Skill variety} + \text{Task identity} + \text{Task significance}}{3} \times \text{Autonomy} \times \text{Feedback from the job}$$

APPENDIX B: JOB DIAGNOSTIC SURVEY NATIONAL NORMS TECHNICAL WORKERS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	5.40	1.00
Task Identity	5.10	1.20
Task Significance	5.60	0.95
Autonomy	5.40	1.00
Feedback	5.10	1.10
Feedback from Agents	4.20	1.40
Dealing with Others	5.80	0.96
AFFECTIVE OUTCOMES		
General Satisfaction	4.90	0.99
Internal Work Motivation	5.80	0.65
Growth Satisfaction	5.10	1.10
CONTEXT SATISFACTIONS		
Job Security	5.00	1.20
Pay	4.40	1.50
Co-workers	5.50	0.85
Supervision	4.90	1.30
INDIVIDUAL GROWTH NEED STRENGTH	5.60	0.57
MOTIVATING POTENTIAL SCORE (MPS)	154	

Note: These norms were compiled by Hackman, Oldham, Stepina. They are based on the responses of 500 employees who work in non-managerial positions (13:23).

APPENDIX C: JOB DIAGNOSTIC SURVEY NATIONAL NORMS MANAGERIAL WORKERS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	5.60	0.94
Task Identity	4.70	1.10
Task Significance	5.80	0.85
Autonomy	5.40	0.92
Feedback from Job	5.20	1.00
Feedback from Agents	4.40	1.20
Dealing with Others	6.40	0.58
AFFECTIVE OUTCOMES		
General Satisfaction	4.90	1.00
Internal Work Motivation	5.80	0.64
Growth Satisfaction	5.30	0.97
CONTEXT SATISFACTIONS		
Job Security	5.20	1.00
Pay	4.60	1.20
Co-workers	5.60	0.68
Supervision	5.20	1.10
INDIVIDUAL GROWTH NEED STRENGTH	5.30	0.54
MOTIVATING POTENTIAL SCORE (MPS)	156	

Note: These norms were compiled by Hackman, Oldham, and Stepina. They are based on the responses of 6930 employees who work on 876 different jobs and 56 organizations (13:12)

APPENDIX D:
TASK CHARACTERISTICS AND
JOB ATTITUDE QUESTIONNAIRE
(13:62-69)

SECTION ONE

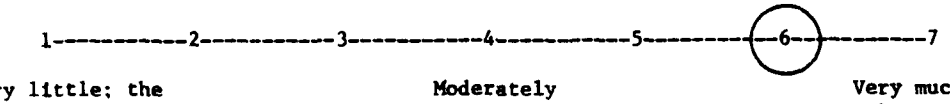
This part of the questionnaire asks you to describe your job, as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and as objective as you possibly can.

This survey is being given to maintenance officers and navigators in SAC. If you have changed jobs and are not working as a crewman or line maintenance officer, then please answer the questions in this survey based on your prior experience as a crewman or line maintenance officer.

A sample question is given below.

A. To what extent does your job require you to work with mechanical equipment?



Very little: the job requires almost no contact with mechanical equipment of any kind.

Moderately

Very much: the *job requires* almost constant work with mechanical equipment.

You are to circle the number which is the most accurate description of your job.

If, for example, your job requires you to work with mechanical equipment a good deal of the time--but also requires some paperwork--you might circle the number six, as was done in the example above.

Please turn the page and begin.

1. To what extent does your job require you to work closely with other people (either clients, or people in related jobs in your own organization)?

1----------2----------3----------4----------5----------6----------7

Very little; dealing with other people is not at all necessary in doing the job.	Moderately; some dealing with others is necessary.	Very much: dealing with other people is an absolutely essential and crucial part of doing the job.

2. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1----------2----------3----------4----------5----------6----------7

Very little; the job gives me almost no personal "say" about how and when the work is done.	Moderate autonomy; many things are standardized and not under my control, but I can make some decisions about the work.	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.

3. To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1----------2----------3----------4----------5----------6----------7

My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service.	My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome.	My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service.

4. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1----------2----------3----------4----------5----------6----------7

Very little; the job requires me to do the same routine things over and over again.	Moderate variety.	Very much; the job requires me to do many different things, using a number of different skills and talents.

5. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1----------2----------3----------4----------5----------6----------7

Not very significant; the outcomes of my work are not likely to have important effects on other people.	Moderately significant.	Highly significant; the outcomes of my work can affect other people in very important ways.

6. To what extent do managers or co-workers let you know how well you are doing on your job?

1----------2----------3----------4----------5----------6----------7

Very little; people almost never let me know how well I am doing.	Moderately; sometimes people may give me "feedback"; other times they may not.	Very much; managers or co-workers provide me with almost constant "feedback" about how well I am doing.

7. To what extent does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing--aside from any "feedback" co-workers or supervisors may provide?

1----------2----------3----------4----------5----------6----------7

Very little; the job itself is set up so I could work forever without finding out how well I am doing.	Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not.	Very much; the job is set up so that I get almost constant "feedback" as I work about how well I am doing.

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or inaccurate description of your job.

Once again, please try to be as objective as you can in deciding how accurately each statement describes your job--regardless of whether you like or dislike your job.

Write a number in the blank beside each statement, based on the following scale:

How accurate is the statement in describing your job?

1	2	3	4	5	6	7
Very Inaccurate	Mostly Inaccurate	Slightly Inaccurate	Uncertain	Slightly Accurate	Mostly Accurate	Very Accurate

____1. The job requires me to use a number of complex or high-level skills.

____2. The job requires a lot of cooperative work with other people.

____3. The job is arranged so that I do not have the chance to do an entire piece of work from beginning to end.

____4. Just doing the work required by the job provides many chances for me to figure out how well I am doing.

____5. The job is quite simple and repetitive.

____6. The job can be done adequately by a person working alone--without talking or checking with other people.

____7. The supervisors and co-workers on this job almost never give me any "feedback" about how well I am doing in my work.

____8. This job is one where a lot of other people can be affected by how well the work gets done.

____9. The job denies me any chance to use my personal initiative or judgment in carrying out the work.

___10. Supervisors often let me know how well they think I am performing the job.

___11. The job provides me the chance to completely finish the pieces of work I begin.

___12. The job itself provides very few clues about whether or not I am performing well.

___13. The job gives me considerable opportunity for independence and freedom in how I do the work.

___14. The job itself is not very significant or important in the broader scheme of things.

SECTION THREE

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own, personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

____1. My opinion of myself goes up when I do this job well.

____2. Generally speaking, I am very satisfied with this job.

____3. I feel a great sense of personal satisfaction when I do this job well.

____4. I frequently think of quitting this job.

____5. I feel bad and unhappy when I discover that I have performed poorly on this job.

____6. I am generally satisfied with the kind of work I do in this job.

____7. My own feelings generally are not affected much one way or the other by how well I do on this job.

SECTION FOUR

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

How satisfied are you with this aspect of your job?

1	2	3	4	5	6	7
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Satisfied	Extremely Satisfied

____1. The amount of job security I have.

____2. The amount of pay and fringe benefits I receive.

____3. The amount of personal growth and development I get in doing my job.

____4. The people I talk to and work with on my job.

____5. The degree of respect and fair treatment I receive from my boss.

____6. The feeling of worthwhile accomplishment I get from doing my job.

____7. The chance to get to know other people while on the job.

____8. The amount of support and guidance I receive from my supervisor.

____9. The degree to which I am fairly paid for what I contribute to this organization.

___10. The amount of independent thought and action I can exercise in my job.

___11. How secure things look for me in the future in this organization.

___12. The chance to help other people while at work.

___13. The amount of challenge in my job.

___14. The overall quality of the supervision I receive in my work.

SECTION FIVE

Listed below are a number of characteristics which could be present on any job. People differ about how much they would like to have each one present in their own jobs. We are interested in learning how much you personally would like to have each one present in your job.

Using the scale below, please indicate the degree to which you would like to have each characteristic present in your job.

NOTE: The numbers on this scale are different from those used in previous scales.

4	5	6	7	8	9	10
Would like having this only a moderate amount (or less)			Would like having this very much			Would like having this extremely much

____1. High respect and fair treatment from my supervisor.

____2. Stimulating and challenging work.

____3. Chances to exercise independent thought and action in my job.

____4. Great job security.

____5. Very friendly co-workers.

____6. Opportunities to learn new things from my work.

____7. High salary and good fringe benefits.

____8. Opportunities to be creative and imaginative in my work.

____9. Quick promotions.

___10. Opportunities for personal growth and development in my job.

___11. A sense of worthwhile accomplishment in my work.

SECTION SIX
BIOGRAPHICAL DATA

All information in this section will be held in the strictest confidence; no one in your organization will have access to individual responses.

1. How much total active commissioned service have you completed? (Check one)

____ A. 4 less than 6
____ B. 6 less than 8
____ C. 8 less than 10
____ D. 10 less than 12
____ E. 12 or more

2. What is your age? (Check one)

____ A. 22-26
____ B. 27-31
____ C. 32-36
____ D. 37-41
____ E. Over 41

3. What is your highest education level? (Check one)

____ A. College graduate
____ B. Some Graduate Work
____ C. Graduate Degree

4. What is your sex? (Check one)

____ A. Male
____ B. Female

5. What is your marital status? (Check one)

____ A. Married
____ B. Not Married

6. What squadron (organization) are you assigned to?

_____

7. What is your current specialty code? _____

8. How long have you held your current AFSC? _____

9. Do you supervise others? (Check one)

____ A. Yes
____ B. No

If yes, how many personnel do you supervise? (Check one)

____ A. 5 or less
____ B. 6-10
____ C. 11-15
____ D. 16-20
____ E. 21-30
____ F. More than 30

10. Do you intend to stay in the Air Force beyond your present commitment?

____ A. No, I am separating
____ B. No, I am retiring
____ C. Undecided
____ D. Yes

If the answer to this question is no or undecided, please answer the following question.

11. Is your present job a major factor in your decision? (Check one)

____ A. Yes
____ B. No

If yes, in what way? Your comments will be helpful in making any recommendations for change deemed necessary by this study.

_____

_____

_____

_____

_____

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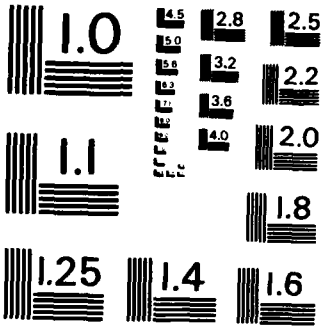

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VITA

Captain Donald L. Dotson was born on 8 March 1951 in Louisiana, Missouri. After graduation from Northeast Missouri State University in 1973, he taught physical education at Oakwood Elementary in Hannibal, Missouri. In 1975, he taught physical education and coached football, basketball, and track at Mark Twain High School, Center, Missouri. He enlisted in the Air Force in 1977 and served as an Electronics Intelligence Specialist at Offutt AFB, Nebraska, in his first assignment. In November 1978, he graduated from Officer Training School and completed the Aircraft Maintenance Officers Course at Chanute AFB, Illinois in May 1979. He served at Offutt AFB, Nebraska thru May 1982 as Inspection Branch OIC, Flightline Branch OIC, Assistant Maintenance Supervisor Organizational Maintenance Squadron, and Avionics Maintenance Squadron Supervisor. His next assignment was at Dyess AFB, Texas (May 1982 - May 1984) where he worked as the Chief of Quality Control, Organizational Maintenance Squadron Supervisor, and Avionics Maintenance Squadron Supervisor. Captain Dotson then entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1984.

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Captain Ted A. Hilbun was born on 3 April 1953 in Memphis, Tennessee. He received his commission in the Air Force upon graduation from the United States Air Force Academy in 1975. He graduated from Undergraduate Navigator Training at Mather AFB, California in May 1976 and completed Combat Crew Training at Castle AFB, California in September 1976. His first assignment was at Beale AFB, California (September 1976 - January 1982) where he served as a Squadron Navigator, KC - 135Q, Instructor Navigator, Standardization/Evaluation Navigator, and Training Flight Instructor Navigator. He was then assigned to Castle AFB, California (January 1982 - May 1984) as a Combat Crew Training School Flightline Instructor Navigator and Combat Crew Training School Academic Instructor. Captain Hilbun entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1984.

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SECURITY CLASSIFICATION OF THIS PAGE

AD-A160883

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFIT/GLM/LSM/85S-19	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Systems and Logistics 6b. OFFICE SYMBOL (If applicable) AFIT/LSM	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State and ZIP Code) Air Force Institute of Technology Wright-Patterson AFB, Ohio 45433	7b. ADDRESS (City, State and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State and ZIP Code)	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT NO.
11. TITLE (Include Security Classification) See Box 19	
12. PERSONAL AUTHOR(S) Donald L. Dotson, B.S.E., Captain, USAF and Ted A. Hilbun, B.S., Captain, USAF	
13a. TYPE OF REPORT MS Thesis 13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Yr., Mo., Day) 1985 September 15. PAGE COUNT 98
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES		
FIELD	GROUP	SUB. GR.
05	09	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)

Work Redesign, Maintenance Officer, Navigator
Job Satisfaction, Work Motivation

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Title: AN ANALYSIS AND COMPARATIVE STUDY OF JOB CHARACTERISTICS LEVELS AND JOB REDESIGN POTENTIAL WITHIN THE STRATEGIC AIR COMMAND MAINTENANCE OFFICER AND NAVIGATOR CAREER FIELDS

Thesis Chairman: Kent N. Gourdin, Major, USAF

Approved for public release: IAW AFR 190-1.
LYNN E. WOLAVER 11 Sept 85
Dean for Research and Professional Development
Air Force Institute of Technology (AU)
Wright-Patterson AFB OH 45433

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Kent N. Gourdin, Major, USAF	22b. TELEPHONE NUMBER (Include Area Code) (513) 255-4017 22c. OFFICE SYMBOL AFIT/LSMA

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

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This study determined the job characteristics levels and potential for job redesign within two Strategic Air Command career fields, maintenance officer and navigator. A survey instrument, the Job Diagnostic Survey, was used to gather the data. The survey results were analyzed and interpreted in the context of Hackman and Oldham's Job Characteristics Model. A literature review thoroughly addressed the Job Diagnostic Survey and Job Characteristics Model, and how these can be applied toward determining the potential for job redesign. The navigator specialty was found to possess a need for job redesign. Survey results showed low scores for the following job characteristics: skill variety, autonomy, motivating potential, and growth satisfaction. The maintenance officer specialty, on the other hand, was not found to need job redesign. The only low job characteristic level was feedback from the job itself. Comparatively, the survey results and Job Characteristics Model indicated that maintenance officers in general are more satisfied with their job than navigators. The research made recommendations on how to effectively redesign the navigator's job and how to improve the feedback aspect of the maintenance officer's job. Conclusions focused on areas for follow-up studies to this research.

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